THURSDAY, DECEMBER 11, 1884

HEALTH LABORATORIES AS THE RESULT OF THE HEALTH EXHIBITION

MEN of science have thus far regarded the South Kensington Exhibitions of the last two years with very languid interest, if not with some suspicion. There has been throughout some show of scientific intent and much promise of serious result. Needless to say, however, that in regard to the Fisheries Exhibition, whatever may be in store for the future, very little of what was promised of solid or scientific result has thus far been definitely realised. That Exhibition achieved a certain success in technical interest and much was hoped in financial result, but there has been a remarkable reticence in respect to the surplus obtained and its proposed disposal. Little, if anything, has been announced in reply to the urgent requests that have been put forward for information on this subject as to the promotion of new knowledge which should aid the protection of the harvest of the sea, or help to give us information, of which we stand sadly in need, as to the best means of favouring the growth and hindering the destruction of the marine staple of food. So far the Marine Biological Association, which has been started by voluntary effort, has not received any promise of or share in the large sum of money which must now be standing to the credit of the Fisheries' Council. That body are in the happy position of having a continuing receipt as lessors of the buildings just vacated by the International Health Exhibition; they will receive a handsome sum for the next two years at least, and probably also in the succeeding years, from the Exhibitions already planned and in course of arrangement. They have a future before them rich in golden promise, and it is much to be hoped that they will not be unmindful of the new Marine Association. The Council of the International Health Exhibition have been more prompt in declaring the results of their work and in announcing some of its probable issues. Of this Exhibition also it was said, while its doors were open, that the element of display and of public attraction appeared to be much more prominent than did the scientific and solid objects which the great body of busy chemists, sanitarians, and engineers were summoned to assist by their work on the General Committees and on the juries. It will be found, however, by the statement which Mr. Ernest Hart makes in another column of the work done and the results achieved, that, although the serious side of the Exhibition was much less a subject of comment than its more entertaining features, the Council have steadily held the former in view and are likely still to do so in the proposed disposal of the surplus in promoting solid objects of national importance. In this Exhibition for the first time the Council went outside the ordinary routine of exhibits obtained from commercial or speculative sources, and at their own cost brought together and created departments of which the object was purely educational. Thus on the sanitary and unsanitary houses there appears to have been expended nearly 1000*l.*, and probably much more than that on the literature of the Exhibition, including a considerable series of hand-books by skilled persons, devoted to the popular exposition of public and private hygiene, and the reports of conferences and lectures. A library was brought together of sanitary and educational works—about five thousand in number. Although far from complete, it was in many departments, especially in those relating to civic, official, and foreign sanitation, more extensive than any that had yet been collected. Of this an excellent printed catalogue was prepared, which is of itself a useful book of reference. Besides this, and perhaps far more important, was the creation of two health laboratories, under the direction of Profs. Corfield and Cheyne. By special application to the French Government a full exhibit was also obtained, illustrating the nature of the work and showing the instruments employed by M. Pasteur and M. Mique in their respective institutes. It is well known that laboratories of this kind are especially important for the scientific study of the bacteriological problems which have to be worked out, and which form the basis of the most important public health researches of the present day. The scheme which was presented to the Council in the early days of its work for the formation of these laboratories contemplated the creation of temporary laboratories, which should be put in working order and should demonstrate the nature of the work carried on in such laboratories, and its close and immediate connection with the interests of the health of man, and with investigations of high commercial value to every department of agriculture, and with the study of the costly epizootics which affect the prosperity of the grazing interest and influence of the food-supply of the nation. These laboratories have been in every sense successful. We have already noticed with satisfaction the paragraph in the report which the Council presented on the closing day of the Exhibition, in which they referred to a proposition that had been laid before them for establishing these health laboratories on a permanent footing as the best possible application of the surplus. The amount of that surplus has not yet been determined, and it is premature to speculate upon it. There is reason to fear that it will be much less than has been publicly rumoured. We have seen it anticipated in print that it will amount to nearly 30,000*l.* On the other hand, we have it on good authority that it is not likely to exceed half that sum. However this may be, it is satisfactory that the address, of which we print a part, and which has a semi-official value, coming from a member of the Executive Council, with the Chairman of the Council presiding, adverts to this application of the surplus almost as though it were a settled matter. Mr. Ernest Hart may of course speak with some excessive hope, inasmuch as it is known that the first establishment of these laboratories was due to his efforts, and they were formed upon the scheme which he drew up for the purpose. The proposition for making them permanent proceeds comes also from him, and no doubt he has a paternal hopefulness which may be excessive. There is, however, evident reason for accepting this most desirable application of the funds as the most probable issue, seeing that the Duke of Buckingham so heartily indorsed it in his speech at the Society of Arts at the close of the address, and that Sir Frederick Abel, also a member of the Exhibition Council, and not likely to speak with other than official caution, stated that Mr. Hart's scheme had now obtained,

he believed, a pretty unanimous consensus of opinion in the Council. Outside, opinion has at once declared itself with strong approval of this application of the funds, and it is indeed evident that, if the Council can succeed in establishing health laboratories which shall find for the health students of this country establishments properly equipped such as those of Pasteur, Koch, and Miquel, the Exhibition will not have lived its short life in vain, but will leave behind it an institution not only of permanent value but of growing importance and of large promise. The Commissioners of 1851 will certainly see with great satisfaction this liberal intention of the Executive Council of the Health Exhibition to add to those laboratories which they have already provided one which is so greatly needed to complete the means of study and of education which South Kensington supplies in other departments of technical and biological research and teaching. They will probably make no difficulty—or, rather, they will have the strongest reason which a desire for national usefulness will give them to overcome any difficulty—in providing a suitable site for such laboratories. Even if the means which the surplus may provide should not be adequate for the establishment and endowment of such a laboratory, there is little doubt that, with this good beginning, so much may be effected as will afford the best possible reason and the largest inducement to societies such as the Royal Society, the British Medical Association, the British Association, and others to make grants to students conducting research in the laboratories. The Government can hardly refuse to make grants in aid of an institution which in any other country than this would be wholly supported by State funds—witness the health laboratories of France and Germany, which are liberally maintained by State endowments. In this country, however, we are accustomed to look to private enterprise, and the liberality of societies or committees, to furnish at least a large part of the funds required for scientific research or endowment, and it is satisfactory to know that the Council of the International Health Exhibition have favourably considered the proposition that they should take the first step in this useful direction. Every one interested in the promotion of real health-progress will trust that it will soon be an accomplished fact.

THE BUTTERFLIES OF EUROPE

The Butterflies of Europe. Described and Figured by Henry C. Lang, M.D., F.L.S., &c. Pp. 396, Super-Royal 8vo, with 77 Chromo-lithographic Plates. 1881–1884 in parts. (London: L. Reeve and Co., 1884.)

FOR some years past the writer of this notice has, almost annually, formed one of the members of that large class of Englishmen who, each year, spend a few weeks in the Alpine and sub-Alpine districts of Europe for "relaxation." The writer prefers to leave it to the taste and fancy of the individuals interested to define the meaning of the latter term. He has naturally met hosts of "foreigners" of different nationalities engaged in the same pursuit. Whatever may be the state of the weather or other conditions incidental to travelling of this kind, those *voyageurs* of Gallic origin succeed in amusing themselves after their own special fashion. The Teutonic element also succeeds, but in an entirely different manner. The Americans seem tolerably successful. They leave home to "do" Europe, and they "do" it, in their own businesslike fashion,—business and pleasure are carried out on the same principles. Then there comes the large class of our own countrymen and countrywomen. We must confess that, according to our observation, the majority of these do not bear the outward appearance of enjoyment (especially the male portion). There is something apparently wanting. They have left their business or profession behind them, and the void thus occasioned cannot be satisfactorily filled in. From these must, of course, be separated those who find enjoyment in the excitement of Alpine climbing, and some others. Amongst these others are those who may be seen with *vasculum* at back, or insect-net in hand (very frequently in ill-disguised clerical garb), enjoying *themselves* to an extent unknown to, and often not understandable by, their fellow-countrymen who have voluntarily placed themselves under the same conditions. Probably a still larger amount of Teutons may be observed provided in the same way. And only this year we found ourselves seated next to a New England divine and his wife, and overheard the latter read out to her husband an advertisement of a butterfly-book, with the remark, "That would just suit *you*."

In the foregoing notes we have tried to draw a picture which we (perhaps we are prejudiced) believe to be tolerably natural. The pursuit of some branch of natural history studies on our travels adds a zest to the other conditions of surpassing value. If pursued systematically, it can hardly be termed "relaxation," if taken to mean "doing nothing." But if the work be harder (and it often is very much harder) than ordinary occupations, it is often the one thing needed, both for health and enjoyment.

Of the bearers of the insect-net in the Alps the majority occupy themselves with butterflies and moths, and the majority of these again with butterflies only. To an Englishman accustomed only to his own meagre, and declining, butterfly fauna, the wealth and beauty of forms is marvellous. With the exception of a small, but useful, manual, published by Mr. W. F. Kirby more than twenty years ago, and which consists almost entirely of laconic descriptions without figures, there has been, up till now, no work in the English language that enables collectors of European (as opposed to British) butterflies to name their captures without the troublesome comparison of some noted collection. These therefore will thank Dr. Lang for having supplied the deficiency, and in a generally satisfactory manner. The author has adopted no new system of his own. He follows Staudinger's German Catalogue, describing (for the most part originally) and figuring those species that occur in Europe proper, and simply describing those that have not occurred in "Europe," but still form part of the "European Fauna" (a term becoming daily more difficult to define). We think there is evidence of a little too much dry routine in the text: the descriptions appear to be excellent, and there is always a notice of the larvæ when known, and tolerably copious geographical information as to distribution, but the class of readers who will mainly use the book would be more readily caught by a mixture of

popular matter, recalling to their minds some of the scenes in connection with their own captures, or serving as a stimulant for future expeditions. But after all it is the *plates* that will be most frequently consulted. Of these there are seventy-seven, mostly crowded with figures, and including a few of transformations. Without the recent adaptation of chromo-lithography, in a superior form, to natural history subjects, the publication of such a work as this (at the price) would have been impossible. The author estimates that there are more than 800 figures on these plates. It is impossible here to criticise them *seriatim*. Those subjects that appear the most difficult are often the best (perhaps more detail in the way of "stones" was used on them), and we are much pleased with the *Hesperidæ*, which, easy as they may look at first sight, must prove very troublesome of application. The "Blues" and "Coppers" (*Lycænidæ*) are fair, but naturally fail in effect where metallic colours are necessary. The worst, to our mind, are those of the *Satyridæ* (of which our "meadow-brown" is a familiar example), and yet they *look* the easiest: we think here there is evidence of trying to make too many species, with varying shades of practically the same colour, accommodate themselves to one "stone." The size is rather too large for a book to be used as a travelling companion, but we think it is rather intended for home study. Paper and type are very good (the former almost unnecessarily so). There is not much to find fault with in the way of uncorrected errors. This is satisfactory, because careless correction is the crying evil of the present day, even in works claiming a much higher scientific position than does this, and often shows up the amount of knowledge possessed by writers of the authors and works they quote. But such glaring errors as the following should not have escaped correction:—Page 47, "Illus. Mag." for "Illiger's Mag."; p. 61 (and elsewhere), "Wein" for "Wien"; p. 153, "Sellmann's" for "Silliman's"; p. 380, "Thurnberg" for "Thunberg"; and, as a crowning morsel, p. 379, "Aumer Kungen" for "Anmerkungen." In notices of some of the recent additions from Central Asia, the author uses indiscriminately (sometimes on the same page) "Samarcand" and "Maracand" as localities; we thought it was generally understood that the latter is only the ancient name of the former.

We have hitherto dealt with this work from a popular point of view. But there is also the scientific side of the question. The book will be of service as collectively giving good descriptions and figures of all known European species brought down to date, and thus avert the necessity of search through a multitude of scattered publications; and in this it will be useful to other than English readers.

On the title-page the author adopts a super-title—"Rhopalocera Europæ." This we think a pity in a work otherwise entirely in the English language.

R. McLACHLAN

ELEMENTARY MATHEMATICS

Lehrbuch der Elementaren Mathematik. V. Schlegel. Pp. 712. (Wolfenbüttel, 1878-1880.)

WE have not had the good fortune to meet with this work, but having now before us an elaborate notice of it by M. Hoüel in the *Bulletin des Sciences Mathématiques et Astronomiques*, December, 1882 (pp. 301-313), we have thought that a few passages from the notice would be acceptable to some of our readers, and lead them to a personal examination of the original treatise.

The writer's opening remarks have much truth in them:—"Nous sommes habitués depuis longtemps à considérer l'apparition d'un traité élémentaire de mathématiques comme un événement pédagogique ou commercial n'ayant rien de commun avec la science pure. Si l'on met à part quelques honorables exceptions, c'est toujours le même livre qui reparaît sous une couverture de couleur différente, avec quelques pages transposées, quelques propositions secondaires introduites ou supprimées, quelques démonstrations modifiées sinon perfectionnées, quelques développements de plus suivant les tendances des programmes officiels. Quant à la manière d'exposer les principes fondamentaux de la science, rien n'est changé. Les découvertes qu'on a faites dans les hautes mathématiques depuis un siècle et qui ont si admirablement éclairci les difficultés que présentaient encore les éléments d'algèbre semblent étrangères à nos auteurs, qui expliquent les imaginaires comme au temps de Bézout et de Lacroix, et présentent parfois à leurs lecteurs des notions géométriques en arrière de beaucoup sur celles qu'exposait Euclide il y a plus de deux mille ans. . . . En Angleterre, l'enseignement est resté ce qu'il était au temps de Barrow et de Simpson; heureusement le vieil Euclide a été choisi et fidèlement conservé à l'abri des prétendus perfectionnements des traités modernes."

M. Victor Schlegel is a pupil of H. Grassmann, and his present work is inspired by the bold views of the author of the "Ausdehnungslehre." It consists of four volumes devoted to arithmetic, algebra, plane and solid geometry, and plane and spherical trigonometry. Vol. i., "Arithmetik und Combinatorik" (182 pp.), treats of elementary algebra and of the theory of combinations. "Le tout est exposé avec une concision qui n'exclut pas la clarté, et avec une rigueur irréprochable." The reviewer's attention is especially directed to an analysis of vol. ii., "la partie vraiment originale de l'ouvrage." In 222 pages are laid down the principles of plane geometry, the ideas in which are those first introduced, we believe, by Grassmann. A full statement is given of the fundamental hypotheses, and the treatise consists of two sections. The first, "Geometry of Figures in Motion," naturally discusses the geometry of the straight line and of the plane; the second, "Geometry of Figures at Rest." A collection of 737 exercises closes the book. The following remark by M. Hoüel is deserving of a place here:—"La tendance de la nouvelle école à remplacer le raisonnement par le coup d'œil nous semble éminemment dangereuse. Le sentiment de la forme est un précieux auxiliaire, auquel les illustres inventeurs de la géométrie pure ont dû une grande partie de leurs découvertes: mais rien en mathématiques ne peut dispenser de la démonstration, d'autant plus que cette partie de la tâche est en général la plus aisée. Dans le cas actuel, la marche d'Euclide n'est pas plus longue, et ne laisse aucun doute dans l'esprit."

The third volume, Rectilineal (or Plane) Trigonometry, is founded, in like manner with the second, on a treatise on the subject published by Grassmann in 1865.

Approving in the main of this volume, we gather that the reviewer differs from the author on some points. M. Hoüel's views we have lately come across in "Rémarques sur l'enseignement de la Trigonométrie" (a paper originally printed in the *Giornale di Matematiche*, t. xiii., 1875, and reproduced in the *Mémoires de la Société des Sciences Physiques et Naturelles de Bordeaux*, 2e série, tome v., 1882, pp. 197-209). He altogether approves of M. Schlegel's appendix, containing a table of *rational* right- and oblique-angled triangles "où l'on puiser d'excellents exercices de calcul numériques."

The fourth volume, devoted to Solid Geometry, is prefaced by an introduction in which the author discusses the most convenient methods for getting clear ideas of figures in space, viz., by the use of models in relief and by stereoscopic images (at the end are plates, corresponding, we presume, to Clerk Maxwell's stereograms, of polyhedra).

"Un auteur se disposant à écrire un traité classique ne saurait trouver une meilleure préparation que la lecture du livre de M. Schlegel, où il apercevrait tant d'horizons nouveaux, inconnus à la routine, et qui eux-mêmes peuvent conduire à des découvertes ultérieuses."

We must not omit to state that M. Hoüel objects to some of the ideas put forward; but the grounds on which he commends the "Lehrbuch" (in addition to others adduced above) are thus summed up:—"Quoi qu'il en soit, nous sommes si peu accoutumés à rencontrer dans les manuels de géométrie des idées neuves et hardies, que nous n'hésitons pas à saluer comme un heureux événement dans la littérature géométrique l'apparition de ce traité, où le disciple fidèle de Grassmann s'est fait le sagace interprète des idées du mâitre sur l'enseignement élémentaire."

OUR BOOK SHELF

The Edible Mollusca of Great Britain and Ireland. With Recipes for Cooking Them. By M. S. Lovell. (London: L. Reeve and Co., 1884.)

WE have received the second edition of this interesting, useful, and in some respects most amusing book. The primary object of the author is to call attention to the qualities and merits of many kinds of shell-fish which are as nutritious as others which are generally known, but which are rarely met with in our markets, or are only used locally for food, while the proper modes of cooking them are scarcely known. Accordingly all the known species of edible shell-fish on our coasts are here described in succession, with the various modes of cooking them. This alone would make the volume of great use at a time when we are going to the uttermost ends of the earth for the sources of our food-supply, and when public attention has been so powerfully drawn to our fisheries by the Exhibition of last year at Kensington. But when we add that the writer has collected from the most varying sources—from an "old M.S." to the Bridgewater Treatises, and from Athenæus to the latest book of travels that is having its little day,—a mass of curious lore about shell-fish, their uses, and the mode of catching them in various parts of the globe, their medicinal properties, the popular superstitions about them, &c., it will be perceived that this is much more than a work on natural history *plus* a cookery-book. If the title were not too suggestive of dulness for such an amusing volume, one would feel inclined to say that "Encyclopædia of the Edible Mollusks" would be a suitable title. And when we examine the formidable list of works "referred to or consulted" at the end, filling with mere titles thirteen pages, we cease to wonder at the out-of-the-way information contained in the volume. Of the nineteen sections in which the subject is treated, that on the *Ostreadæ* is, as might be expected, the longest, although that on the *Helicidæ*, which is also comparatively long, appears to us the most amusing. We hear of many infallible corn solvents, corn-destroyers, and the like, but the prescription of Master Ralph Blower, who wrote a certain "Rich Storehouse or Treasurie for the Diseased," possesses at least the merit of originality. Here it is. "Take black sope and snailes, of each a like quantitie, stampe them togither, and make plaister thereof, and spread it upon a piece of fine linnen cloth, or else upon a piece of white leather, and lay it upon the corne, and it will take it cleane away within seven dayes space." Master Blower who, by the way, wrote "for the benefit of the poorer sorts of people that are not of abilitie to goe to the Physicians," supplies the recipes for other cunning decoctions of snails, as do several other physicians who are quoted. Snail-water appears to have been considered a sovereign cure for consumption; but it may not be generally known that a large trade in snails is carried on for Covent Garden Market in the Lincolnshire Fens. They are sold at *6d.* per quart, and it appears that they are still much used for consumptive patients and weakly children. Of all the many uses of snails in various parts of the globe, the strangest perhaps is that discovered by the London adulterator. They are much employed, the author assures us, in the manufacture of cream, being bruised in milk and boiled, and a *retired* milkman pronounced it the most successful imitation known! There are, we should say in conclusion, many beautifully coloured illustrations.

Forestry in the Mining Districts of the Ural Mountains in Eastern Russia. Compiled by John Croumbie Brown, LL.D., &c. (Edinburgh: Oliver and Boyd; London: Simpkin, Marshall, and Co., 1884.)

STILL another book on forestry by Dr. Brown, uniform in size and binding with those that have preceded it. We have before alluded to the readable character of Dr. Brown's books, and the one before us is no exception to those on "The Forests of England" and the "French Forest Ordinance of 1669"; indeed it is perhaps more popular in its style, which Dr. Brown is not entirely responsible for, as he states on his title-page that it is a compilation, and the free use of inverted commas shows it to be so to a great extent. Though the book may contain a very good description of the country under consideration and accounts of the several journeys made in Russia, we are bound to say that not more than half deals with forestry matters. Thus we have one chapter devoted to the journey from St. Petersburg to Moscow, including a description of the Nijni Novgorod Fair. Another chapter describes the "Mishaps and Difficulties Experienced in Travelling"; another "Metallurgy"; and another "Depressed Condition of Mining, Smelting, and Manufacturing Establishments." The chapters that deal with forestry in some form or another are on "Forest Exploitation in the Government of Ufa"; "Abuses in Connection with the Exploitation of Forests"; a short one on "Forests," &c.

It may be stated that Dr. Brown's several works on "Forestal Literature" were awarded a silver medal at the recent Forestry Exhibition in Edinburgh, a fact to which he draws attention at the commencement of the present volume.

Die pyrenäische Halbinsel. Von Dr. Moritz Willkomm. II. Abteilung: "Spanien." (Leipzig: G. Freytag, 1884.)

THIS forms one of a series of volumes on the countries of the world, and appears to be part of a German "Universal-Bibliothek" entitled "Das Wissen der

Gegenwart." It is clearly printed, has numerous illustrations, and the information, which is excellently arranged, is brought down to the latest date and is very full. The volume and the series are of a kind more numerous and popular in Germany than in England.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to insure the appearance even of communications containing interesting and novel facts.*]

The Prime Meridian Conference

IN *La Nature* of November 22 (p. 399) appears what is represented as information obtained at the meeting of the Academy of Sciences at Paris on November 17. It is stated that the proposal made by Prof. Janssen at the Meridian Congress at Washington, relative to the application of the decimal system to the measurement of angles and time, obtained a majority of 24 votes against 21, notwithstanding the "opposition *très-vive*" of the English and Americans. The vote to which reference is made was not on the merits of Prof. Janssen's proposal, but merely whether the opinion of the President that the Congress was not competent to entertain it, should be upheld or not. The decision being in favour of considering it, the proposal was accepted unanimously. On turning to the *Comptes Rendus* of the Academy I find it simply stated that M. Janssen observed that his proposition had been accepted almost unanimously, and without a vote in opposition.

La Nature further refers to the British delegates as having made the discussion on the prime meridian a question of "*amour-propre*," and as having converted to the British cause most of the representatives present. This statement is no less inaccurate and misleading than the former. As M. Janssen himself remarked at Washington, England did not make the proposal to adopt the meridian of Greenwich, and though the British delegates differed from their French colleagues as to the considerations which should govern the choice of a prime meridian for longitude, there was not a word said by them to justify what is stated by *La Nature*, and it is manifestly absurd to speak of the conversion of the representatives to the British cause, inasmuch as it is a perfectly well-known fact that almost every one of them came to Washington with instructions from their own Governments to vote for the Greenwich meridian. In justice to M. Janssen I wish to add that the *Comptes Rendus* makes no reference whatever to anything having been said by him on this subject.

It is greatly to be regretted that a journal professing to be scientific should have given a colour to the discussions which took place at Washington that forcibly suggests a deliberate intention of exciting national jealousies and animosities.

RICHARD STRACHEY,
December 5 Late Delegate at Washington

IT is to be regretted that the French delegates have declined to accept some of the resolutions of the Prime Meridian Conference, but it is to be hoped that their non-adherence is only temporary; at the same time it must be admitted that their contention that Greenwich is not a scientific starting-point for a universal meridian has much to be said for it; the zero of longitude ought certainly to be defined somewhere on the equator, and if it were to be hereafter so defined at a point on the equator having the same meridian as the Greenwich instrument it is probable that all difficulty would be removed. The French are known to attach importance to ideas, and doubtless do not like the apparent supremacy which would be conferred on Greenwich if it were made the actual centre of departure. The point in question lies somewhere in the Atlantic Ocean, and is therefore on perfectly neutral territory.

One of the great obstacles to the introduction of the French metrical system into this country lies in the forbidding and inconvenient nomenclature attached to it. If the long compound names were translated into short English monosyllables, such as *met*, *kim*, *mim*, &c., not only would their use be greatly advanced and facilitated, but the French nation would in time borrow back from us our nomenclature. Such words offend at first sight by their new and startling aspect, but this all wears off in an hour or two; they require however to be started by some one in authority. There is a strange and unreasonable prejudice in the present day against the introduction of new monosyllabic words without derivation, which happily for us did not prevail in the days of our early forefathers.

It is desirable that at future meetings of the Conference the question of astronomical nomenclature should be considered; the practice of using the same names for sidereal and mean time is extremely inconvenient. I have suggested that the sidereal hour should be called a *sid*, or *sider*, and the second a *cron*, so that sidereal time would be indicated by the letters *s*, *m*, and *c*. Some such change is greatly needed, and new names should also be assigned to minutes and seconds of arc.

London, December 1 LATIMER CLARK

The Electric Light for Lighthouses and Ships

THE application of the electric light to lighthouses and ships appears to me to be capable of considerable extension by a modification of the apparatus used. In lighthouses the practice is to have a fixed light in the lantern, with an apparatus either catoptric or dioptric, or a combination of both, for the purposes of bringing the rays of light from the arc into a parallel beam and sending them to the horizon. Sometimes, if not generally, this beam is cylindrical, and sweeps round at intervals of time as the combination of lenses and reflectors is rotated.

In the case of ships the head-light is an ordinary arc light, and searchers in use on men-of-war are arc lights set in the focus of a parabolic reflector, and pointed straight at the object it is wished to light up.

The arrangement that I would suggest as partly applicable to lighthouses and fully applicable to ships would be to use a fixed arc-light and large parabolic reflector in combination with a large, light, plane or suitably curved mirror to direct the beam of light, rendered parallel and cylindrical by the parabolic reflector, in any direction by means of this mirror only.

To apply this principle to a lighthouse, this light movable mirror would be placed in the lantern at an angle of something less than 45° with the vertical; the arc light and the fixed parabolic reflector would be placed below, centrally, in the tower; the light would then come from the parabolic reflector on the plane mirror, and so be sent in the required direction.

In using this mirror, where the light has to sweep over an angular area of less than 360°, I would use a to-and-fro motion, so that if the time of each sweep from side to side was 30 seconds of time, then any vessel in the middle line would have the light at this interval, but at any angular distance from the centre line the duration of the flashes would differ until, at the extreme range, two would be seen almost together, with almost 60 seconds interval between them and the next two, the sum of the time of two intervals always being the double of the fixed time for that light, and the difference between two intervals for all positions off the central line would enable the distance from the centre line to be determined by a vessel within the range of the light. An arrangement similar to this would answer for masthead lights for ships, the arc light and parabolic reflector being below deck, a light metal tube, terminating with a lantern to carry the plane mirror, going from the deck up to the required height in front of the foremast; the movement in azimuth of this mirror might be of the same kind as that mentioned for the lighthouse, but a much quicker motion from side to side, through 180° in about five seconds, would then give this time for all points in a straight line ahead, but vary at the sides in the manner already mentioned. As the light plane mirror has only to be moved, a clockwork arrangement would answer perfectly well for this purpose. In rough weather, when the vessel rolled, the light would have a tendency to vary too much in the vertical direction, but it would not be difficult to make the correction by a gravity counterpoise.

For war-ships such an arrangement, but on a more powerful

scale, would answer for a searcher, and the motions could be given by simple mechanical means or by means of electromotors worked from any point. Here the chief working parts of the apparatus would be fully protected, and this would be of the first importance, and the rapidity with which the light could be directed to any point or rendered quite invisible would be a great improvement on the present model, where all has to be exposed.

For forts requiring powerful searchers, and it is easy to see that they might be of great use here, this arrangement is suitable, particularly as the mark, being stationary, is more likely to be struck than in a ship; but the replacing of the plane mirror would be easily effected, and other part of the apparatus of course being quite protected, as in the case of ships.

In the case of a fort in a channel that it was desired to protect, the beam of light from a powerful fixed parabolic reflector could be so truly sent that it could be reflected from mirrors at a distance, as on the banks of the channel, so as to sweep across close above the level of the water and show the smallest object crossing the illuminated line.

It may be objected that in this second reflection there will be a loss of light, but that loss can be made very small, and there would be positive gain in using a large parabolic mirror in place of the necessarily small and imperfect ones in use in a lantern of a lighthouse or the deck of a vessel. Such a parabolic mirror could be made accurately in sections of very thin glass silvered at the back so as to retain its reflecting powers for an indefinite time; in the case of a lighthouse it might be placed at any point vertically below the lantern, even at the bottom if the tower had a well as large as the intended beam of light. The large mirror above may be also of thin glass silvered in a similar way and with such a slight curvature as might be required to enlarge the beam in any way, and more than one of these mirrors might be used if it was necessary to have a fixed light in one constant direction or for any other purpose. I am not sure if there would be any gain in the power to penetrate fog. In the case of a head-light, there would be certainly, from the collection of light into a beam instead of the naked arc; but whether a light such as the very small point that forms the arc including the incandescent carbon ceases to affect the eye in fog sooner than the same intrinsic light seen as a surface must only be settled by experiment on a proper scale.

Ealing, December 5 A. AINSLIE COMMON

Natural Science in Schools

IN the interesting discussion which has recently been carried on in your pages on the teaching of natural science in schools, not much has been said about the text-books which are, or should be, read. So long as the present system of teaching a single branch of natural science continues, and until the method recommended by Prof. Armstrong is adopted, it is clear that great care should be exercised in the choice of a good text-book on the particular subject selected. Even when it is found possible to teach science in the form of physiography, or *Naturkunde*, there will doubtless be many boys in the large schools who, having thus obtained a great amount of most valuable general knowledge and a wider view of the aims of science than is possible under the present system, will wish to carry on their studies in a particular direction. Taking chemistry, as the subject with which I am most familiar, and which at present is perhaps more widely taught than any other branch of science, it may be said that there should be no difficulty at all in selecting a suitable book. It is true that the number of text-book of chemistry is extremely large, and it is also true that there are a few books, written by men of wide knowledge and long experience in teaching, which are well adapted to the purpose in view. But it is, unfortunately, equally true that there are many text-books which are either untrustworthy or are badly arranged, or which contain little more than a bare collection of dry facts, and it is to be feared that some of these not unfrequently find their way into schools. Doubtless most teachers of chemistry will agree with Prof. Armstrong that the educational value of a course of instruction dealing merely with the methods of preparation and the properties of a number of elements and compounds is extremely small, because the faculty of reasoning from observation is not thereby developed. It will also, I think, be generally admitted that "it is of great importance that the meaning of the terms 'equivalent,' 'atomic weight,' 'molecular weight,' should be thoroughly grasped at an early stage." But it would perhaps be better that students should remain in complete ignorance of the meaning of these terms than that they should obtain such erroneous and illogical notions of atoms and molecules as are contained in some of the text-books. One of these books, which in 1880 had passed through no less than fifteen editions, and which appears therefore to be largely read, and which is advertised as being recommended by the head-masters of certain schools, contains the following remarkable statements:—

"Chemists *assume* that the elementary bodies are built up of infinitely small particles, which they call atoms; they further *assume* that these atoms, with few exceptions, are all of the same size. . . The exceptions are phosphorus and arsenic, whose atoms are believed to be half the usual size; and zinc, cadmium, and mercury, whose atoms are double the size." (The italics are the author's.) To the uninitiated it might appear strange to argue about the relative sizes of infinitely small particles.

Again:—"*All molecules are of the same size;* for the law of Ampère, which most chemists now accept, states that 'all gases and vapours contain the same number of molecules within the same volume.'"

Most of the errors contained in these statements are of course due to a misapprehension of the meaning of Avogadro's (Ampère's) law. It is not very easy to give an average student a clear conception of the fundamental generalisations and theories by means of which chemists have been able to determine the most probable relative atomic weights of the elements. To do this, it is first of all necessary to induce the student to think and reason for himself, and it seems to be much easier for most people to repeat a thing from memory than to understand it. But when the student's memory has already been stocked with such illogical statements as those quoted above, the difficulty is very greatly enhanced. SYDNEY YOUNG

University College, Bristol

The Edible Bird's-Nest

THE nature of the material from which the edible bird's-nest is formed has been long the subject of controversy. It is very gratifying to find from Mr. Layard's letter, published in last week's NATURE (p. 82), that a reconciliation of the various views is possible. Most writers support the theory that the substance is secreted in some way by the bird, though they differ as to the manner. Sir E. Horne, in a paper published in the *Phil. Trans.*, 1817, suggests certain gastric glands as the active ones. Bernstein, forty years later, points to the prominence in the nest-building season of certain salivary glands which form cushions by the sides of the bird's tongue, and suggests that these secrete the material. On the other hand, there are advocates of the view that the nest is constructed of certain vegetable matter found by the birds in the caves where the nests are built, and agglutinated by them by a buccal or salivary secretion.

Through the kindness of Prof Michael Foster I have been enabled to make some observations on the chemical nature of the material of the nests used for soup at the recent Health Exhibition, and from my experiments I have come to the conclusion that this is a substance resembling very closely the *mucin* described by Eichwald, Obolensky, and other writers, as forming the chief constituent of the mucous secretion of all animals and of the tissues of *Helix pomatia*, &c. It shows under the microscope scarcely any structure, but is laminated, shells splitting off easily in two directions. It contains here and there certain bodies resembling the cells of squamous epithelium. It is insoluble in either cold or warm water, but swells up in either, forming a gelatinous-looking mass; in both lime-water and baryta-water it is slowly dissolved, and the reactions of the solution differ very little from those described by the writers named as those of mucin. It resembles this body also in its behaviour when heated with acids, alkalies, and the different digestive ferments. The solution in lime-water contained a little debris, which proved to consist largely of pieces of feathers, with a little adherent amorphous matter. With the exception of certain microscopic particles among this, I could not get any evidence of the presence of vegetable matter in the nest substance. Indeed all the experiments I have described point certainly to the absence of anything but a glandular secretion.

JOS. R. GREEN

Physiological Laboratory, Cambridge, December 1

The so-called South Plant of Egyptian Art

THE identification of the original source of any conventionalised artistic form is always, I think, worth notice. It will probably interest many readers of NATURE to draw their attention to a short but instructive piece of work of this kind which Prof. Julius Lange has communicated to the Royal Academy of Copenhagen (*Bull.*, 1884, pp. 109-114). I am indebted to Mr. Liden, one of our garden staff at Kew, for a translation of the paper from the original Danish. I have freely condensed the details.

There is a well-known Egyptian symbol which represents both Northern and Southern Egypt. The northern symbol is admitted to represent the stem and head of the Papyrus. But the southern symbol has not hitherto been identified with any certainty. It has a lily-like form, and has been generally referred to the Lotus (*Nymphæa*), an identification which Prof. Lange thinks quite inadmissible, as the conventionalised treatment of this plant in Egyptian art is quite different.

The twin-symbol combining in a kind of knot the north and south plants is commonly found inscribed on the thrones of statues of Egyptian kings. In the later examples the south plant has the form of a flower with three divisions of the perianth depicted (implying that it was either five- or six-parted), and a definite flower-stalk. In one case Prof. Lange met with an example where the flower was separated from its stalk by some transverse carved lines.

Prof. Lange has, however, recently examined a diorite statue of King Chefren, which gives the symbol in a more primitive form. He finds that the supposed flower passes imperceptibly into the stalk, and that the apparent perianth segments are really distinct parts which are tied together by indications of ligatures. Without then arriving at any definite conclusion, he is content to point out the resemblance of the south symbol in this form to the palm-capitals of the Ptolemaic period. In these the leaves of the date are disposed round the body of the capital, and the junction of this with the column is indicated by transverse bands, the conventional representations of the ligatures which would hold the leaves together and in their places. As the date, according to Alphonse de Candolle ("L'Origine des Plantes cultivées," p. 240) has existed from prehistoric times in the dry and hot zone from Senegal to the basin of the Indus, between lat. 15° and 30°, a more characteristic plant as the symbol of Southern Egypt can hardly have been pitched upon.

W. T. THISELTON DYER

Earthworms

I SEE, in your issue of October 9 (vol. xxx. p. 570), an interesting communication entitled "A Gigantic Earthworm," in which the writer refers to worms of large size being fairly common in parts of Cape Colony. I may mention that here in Ceylon it is not an infrequent sight to see two or three of these big worms in the same day, after showers, though I would not pronounce them to be exactly common. I have seen some fully four feet in length, and about the thickness of one's little finger. They are of a pale slaty-bluish colour, and appear, on close examination, to have faint prismatic colours over parts of the body. These worms are seemingly not confined to particular soils or altitudes, as I have met with them at elevations of from 2000 to 4000 feet above the sea. Owing to their seeming inertness of body, the *leb-worms*—as I have frequently heard them called—soon fall an easy prey to swarms of small red and black ants, that attack the victim as it lies on the ground.

Passing from large to small, I may mention a curious earthworm that I found to be very common in North Borneo. The chief peculiarity about this worm is the size of its "cast," this being about four inches high by one inch and a half across the top, which is made cup-shaped or with a marked depression, for the purpose, I believe, of catching water. The stem—if I may apply the word—of the "cast" is about an inch in diameter, strongly built of rows of earthy matter laid circumferentially, widening towards the top into a lip that forms the side of the cup. Sometimes a leaf may have fallen on the "cast" in the course of erection, and this is at once built over, so that part of the "cast" may be seen above and part below. The worm itself is very small, and hard to secure. I have found the only method of catching them was to suddenly break off a fresh "cast," when one could get a glance of the worm as it rapidly withdrew into the ground. It is of a fleshy red colour, and about the thickness of the stem of a crow-quill pen, but I do not know how long, as I never succeeded in extracting a whole worm from its burrow. The "casts" are very numerous, and weigh, I should think, quite an ounce each, and are to be met with both in the forest—as well as in gardens—and cultivated land. I also found them close to the banks of rivers that were sufficiently near the sea to be considerably impregnated with salt, so that I conclude from this that salt water is not destructive, at least to this species.

FREDERICK LEWIS

Bogawantalawa, Ceylon, November 5

Injuries caused by Lightning in Africa

IT is a remarkable fact that in all the publications relating to Africa we so seldom come across accounts of injuries caused by lightning. Some travellers—those of the German Loango Expedition of 1873-76 for example—even distinctly report that, notwithstanding the extreme frequency of lightning in Africa, cases of damage inflicted by it are almost unheard of. During my own stay on the Congo, though I was eagerly on the look-out for instances of this kind, I did not succeed in authenticating a single case of injury due to the electric fluid. There was indeed a vague rumour among the natives of a man in some village having been struck dead and a "tshimbek" burnt down by lightning, but I could find no eye-witnesses of the fact; and all the time I was in Africa I never saw a tree or other object which showed any signs of having been struck by lightning. The only case of which I obtained any authentic report was that the coal-magazine of the French factory at Banana was burnt down in consequence of a lightning-stroke in March 1882. I have been recently informed, however, that just a year after the destruction of the French coal-magazine, the large gin-store of the Dutch factory at Banana was similarly destroyed, a flash of lightning having kindled a great fire there which lasted four days. As a result of these two accidents following so close on one another in the same locality, lightning-conductors are now being set up at Banana, and the International Association of the Congo has had conductors fixed on all the magazines at Vivi.

I find in Dr. Pogge's journals, which I am now preparing for publication, an instance, witnessed by that traveller himself, of a man being killed by lightning. As far as my own researches go, I find scarcely any literature concerning the use of lightning-rods or the frequency of accidents from lightning in the tropics; and if any of your readers would communicate to the columns of NATURE any information relating to this subject which they may have gained by a residence in those regions, they would render a great service to meteorological science.

Hamburg, November 29 VON DANCKELMAN

The Northernmost Extremity of Europe

YOUR correspondent, Mr. Mattieu Williams, says, on p. 54 that Tönsberg "is admitted by all as a high authority" on Norway. May I be permitted to ask who these "*all*" are? I knew this gentleman very well, and he never claimed the least *geographical* authority for a faulty and crude "Guide for Tourists," which is all that his work is. I beg to refer your correspondent to the preface, where the author himself says that, for reasons explained, it has many faults. To set Tönsberg up as a *geographical* authority would indeed be an insult to Norwegian geographers. Your correspondent further says that he saw with his own eyes, ten years ago, that Knivskjærodden jutted further north than the North Cape. Had I happened to meet him before he started on his excursion, I, then but a schoolboy, could have informed him of this startling fact. What I said was, that we had assumed it, but it had only been *proved* by measurements this summer. That was all. As regards the *height* of the promontories on the coast of Arctic Norway, I am sorry to have to repeat my contradiction that there is no single one which is higher than the North Cape. Your correspondent again quotes Tönsberg. If quoting this "high authority" at all, the statement should be correct. Your readers are informed that this guide-book says that Sværholtklubben "is *twenty-four* Norwegian (why *Norsk*? if Norwegian it should be *Norske*) feet higher than the North Cape." Tönsberg says nothing of the kind. What he says is simply that it is *upwards of* (*henved*) 1000 feet, and from this vague guess your correspondent evolves a fresh discovery and figures. Had he taken the trouble to consult the poorest of our geographies, he would have learned that the North Cape is *indisputably* the highest headland in Finmarken. His concluding statement that there are a dozen others is merely an imaginative one.

As a foreigner, I cannot refrain from remarking that it seems strange to me that, because a man has paid a few weeks' visit to Norway, and even "halted in front of the North Cape for half an hour," he can claim to have become an authority on all scientific and other matters connected with that country among a nation which can boast of such distinguished explorers and *savants* as the English. A NORWEGIAN

The Scandinavian Club

Our Future Clocks and Watches

IN connection with the indication of universal time by our future timepieces, I venture to suggest that the hours should be contained in one circle; but, instead of being numbered consecutively from 1 to 24, they might be arranged in Roman numerals, as at present, and if figured alternately would be almost, if not quite, as distinct as on the faces of our present style of clocks. Thus, the hours 2, 4, 6, &c., would be shown in figures, but the intermediate or odd hours, as 11, 13, 15, &c., would be more advantageously distinguished by an arrow-head or circular dot.

As regards the striking of the hours by our public and private clocks, they might strike up to twelve, as at present; the suggestion of your correspondent "R. B." (NATURE, vol. xxxi. p. 80), that they should not strike any number above six, appears to me as objectionable as if they struck up to twenty-four; but to distinguish between the afternoon and morning hours, the hours from thirteen to twenty-four might be distinguished by being preceded by two strokes in rapid succession either upon the bell which strikes the hours, or, preferably, upon a bell of a different tone. B. J. HOPKINS

Leyton, Essex

Singular Optical Phenomenon

ON the night of November 28, at about six in the evening, I went to the window to look at the moon, and saw, as it were, a *second* moon behind the other. The effect was so like what one sometimes experiences from suddenly going out of a very light room, or other causes, that at the time I fancied it was only a defect in my sight. On going into my son's room an hour afterwards he said: "If something is not gone wrong with my eyes, there are two moons out to night." On this I went out again, but saw only the one moon as usual. Later in the evening a young girl who had been meeting a friend at the Montreux train, said her friend had said the moon looked *queer* all the while she was in the train. The night previous a pretty severe shock of earthquake occurred in Geneva and Lausanne, and a few hours after we had observed the moon on the 28th, a very violent gale and snowstorm took place, and lasted for about six or eight hours. I am not scientific enough to know whether the "rosy glow," reported on November 28 by Mr. Leslie of Southampton, can have any connection with this, or whether my letter will interest your readers. X.

Vevey, Canton de Vaud, December 6

The Aurora Borealis

WITH the view of making the Norwegian catalogue of the aurora borealis, at which I am now working, as complete as possible, I take the liberty of asking meteorological societies which are in possession of journals supplied by those who have navigated *Norwegian waters*, to be good enough to place within my reach a copy of the observations which these journals contain respecting the aurora borealis seen near *the coasts of Norway or in their neighbourhood*. I should also be equally grateful for all information with regard to other unpublished observations of auroras of Norway, which may perhaps be found in the archives of meteorological institutes. SOPHUS TROMHOLT

The Meteorological Institute of Christiania, November 19

THE UNITED STATES FISH COMMISSION

IN the year 1871 the Congress of the United States had its attention directed to the alarming decrease in the abundance of its east coast food fishes, and appointed a Commission to investigate the matter, with the idea of preventing the decrease. Prof. Spencer F. Baird, then Assistant Secretary of the Smithsonian Institution, was appointed at the head of this Commission, and in the early summer of 1871, with a small but efficient corps of naturalists, he established himself upon the southern coast of New England at a place called Wood's Holl. Among the most noted of the members of that party were A. E. Verrill, S. J. Smith, and Sanderson Smith, all of whom have remained with the Commission every summer since its foundation. The first work of the Commission was to investigate the fauna, which then was comparatively unknown to science. In this way the food-supply of the food fishes and the food fishes near shore were carefully studied. During this one summer the fauna of this region was so carefully studied specifically that few new species have since been discovered. The main results were set forth in a very extensive report upon the invertebrate animals of Vineyard Sound by Profs. Verrill and Smith, and published in the first Fish Commission Report. In the summer of 1872 Eastport, Maine, was chosen as the station, and here the same systematic study was carried on with the addition of some dredging work done in shallow water with small boats. The summer of 1873 was spent at Portland, Maine; 1874 at Noank, Conn.; 1875 at Wood's Holl again; and 1876 being Centennial year, there was no summer station, but the energies of the Commission were exerted upon the Centennial Exhibition at Philadelphia. In 1877 a part of the year was spent at Halifax, Nova Scotia, arranging a fisheries treaty, and the remainder at Salem, Mass. The head-quarters for the summer of 1878 were at Gloucester, Mass. Up to this time, and, in fact, until 1880, the Fish Commission had carried on all its off-shore work in steamers placed at its disposal through the courtesy of the Coast Survey and Navy Department, but had owned no boat of its own with the exception of small sailing-boats and a steam-launch in which the shore work could be done. Thus under a decided disadvantage, it would hardly be expected that a great amount of work could be carefully done; but, notwithstanding this, a large part of the Gulf of Maine was very carefully explored, under the direction of the Fish Commission. During the years 1878 and 1879 the fishermen of Gloucester very materially aided the Commission in its work of investigating the fauna of the shallower water of New England by preserving such specimens of animals as they happened to meet on their fishing trips. Scores of animals new to the American waters were taken from the fishing-banks by these fishermen, and the importance of their work should not be under-estimated.

As yet the Fish Commission had done little practical work in its marine departments. It was for practical work that the Commission was established, and all its scientific work had some practical object in view. In the winter of 1878 and 1879 the Commission began important experiments upon the hatching of deep-water fish, but more especially cod. When America was first discovered, cod were found on all its shores in great abundance, and from this abundance the headland of Cape Cod received its name. As white men became more numerous on the shore and cities began to grow, the fish began gradually to decrease in number and be driven off into deep water because of the impure condition of the water. Now, in places where fifty years ago cod could be caught from any point of rocks, it is a rare thing indeed to catch this fish within several miles of shore. Men, who not many years ago could anchor a boat within a few rods of shore and catch fish in large quantities, are now obliged to visit the more remote ledges several miles from shore, and be satisfied with a light catch. Even in the deep water they are becoming scarcer. It was with the hopes of finding some remedy for this decrease that in 1878 and 1879 Prof. Baird began experiments upon artificially hatching these fish. Millions of eggs are laid where few come to maturity, the larger part being destroyed before they are hatched from the egg. Thus, if the eggs could be hatched and the

young placed in the water only when they are old enough to partially take care of themselves, the proportion that would arrive at maturity would be vastly increased. By constant work at hatching these fish it was thought that much practical good might result. Many difficulties stood in the way, the most important being that the eggs floated and clogged the overflow screen. After much experimenting this was overcome. It was found, however, that the place chosen, Gloucester, was by no means fitted for the work because of impure water and extreme cold; but the object of the present work was merely experimental, and it mattered little whether the fish which were hatched lived after being placed in the water. Several millions of young cod were thus successfully hatched and placed in the waters of Gloucester Harbour, but, because of the impurity of these waters, it was hardly expected that the fish would be heard of again. But early in the spring of 1882 reports began to be circulated that young cod-fish of the deep-sea species (*Gadus morrhua*) were abundant in Gloucester Harbour. Subsequent investigation proved this report to be true. Since the cod first left our coast they have not been found in the Massachusetts harbours in any abundance, but at this time, even in the impure docks of Gloucester Harbour, it was not infrequent for boys fishing for perch and flounders to catch young cod. Several generations were distinguishable, and as there is but one other place where a similar abundance is reported, there is every reason to believe that they are Fish Commission cod, and that the other school is but an offshoot of the original group which was placed in Gloucester Harbour. It is, of course, expected that they will migrate, in time, to purer, cooler waters outside. There are fishermen now who are making good catches of these cod in the harbour itself—a thing unprecedented in late years. Thus the experiments, though primarily successful, have met with an additional success which was not in the least expected. Gloucester not being naturally suited for hatching cod, the Commission has begun the building of extensive hatching-houses at Wood's Holl, where in a few years artificial hatching of deep-sea fish will be carried on extensively. While at Gloucester the members of the Commission made extensive inquiries into the statistics of American fisheries, and complete reports upon the results have been published in the Fish Commission publications.

The summer of 1879 was spent at another large fishing port, Provincetown, Mass., where additional studies of the fishing apparatus were carried on. In 1880 the Commission was at Newport, Rhode Island; 1881, 1882, 1883, and 1884 were spent at Wood's Holl, Mass., which has been chosen as the permanent summer station of the Commission, because of the many natural advantages offered by the location. At present extensive buildings are in progress at this station. A large hotel for the use of the Fish Commission *employés* is already built, and was for the first time occupied during the past summer. On one side of this hotel the new laboratory and hatching-station is being built. It will be a very large affair, the lower story being intended for use as a hatching-room, the upper for a laboratory in which the scientific work will be done. In the cellar there are some large stone-walled tanks which will have direct connection with the outside water. A steam pumping-station will supply water to the aquaria and hatching-tanks. In front of these buildings is a large breakwater wall which will serve the purpose of a wharf for the larger vessels, and will also form a harbour for the smaller boats. It is expected that actual operations in fish-hatching at this station will begin in the spring of 1886, and that after that time each year millions of young fish will be sent out from the station to all parts of the New England coast and placed in the water to take care of themselves. It is hoped by these means to at least make an appreciable difference in the number of cod after years of work, and in part make up for the decrease. In the laboratory not only the regular *employés* of the Fish Commission will be allowed to work, but in the future a limited number of general students will be admitted to a table in the laboratory. By special arrangement with several of the leading American colleges, two students from each will be allowed to work each year in the new laboratory. This will be a chance that will be eagerly sought after because of the great advantages for study offered at the station. Under these improved advantages, it is expected that much better work will be done in the future than has been done in the past, when all the work had to be carried on in an old shed-like building poorly fitted for the work.

In 1880 an appropriation was obtained from Congress for the purpose of building a steamer, which was to serve as a floating shad-hatching station to work in the Chesapeake. This was the first large steamer owned by the Commission, and was named the *Fish-Hawk*. Although intended for shad-hatching, at the end of each shad-hatching season she proceeded to the summer station to engage in dredging. On account of her shallow build she was not fitted for dredging, and the Fish Commission was greatly inconvenienced while she was used for this purpose. The remarkable results obtained by this steamer on the Gulf Stream slopes have long since become known to the scientific world. Several hundred species were found which were new to American waters.

It was not long before the Fish Commission became convinced of the necessity of having a new steamer in which they could go to sea at any time, and one which was perfectly adapted for deep-sea dredging. Accordingly, in 1883, the *Albatross*, a 1000-ton iron steamer, 234 feet long and drawing 12 feet of water, was launched and immediately began work. That she is very nearly perfect in all respects, both in build and outfit, has been proved by her two years of nearly steady work. She is without doubt the most perfect dredging-steamer ever owned by any Government, and she is achieving the most remarkable results.

In the spring of 1879 a new fish, the tile-fish (*Lopholatilus chamæliionticeps*), was found in abundance in the deep water south of New England, which promised to become an addition to our east coast food-supply. It was abundant and had a fine flavour. In the early spring of 1882 it was found dead in immense numbers on the surface just above the places where it was found in such abundance. In the official report it is estimated that there were at least 71,936,000 dead fish, of an average weight of ten pounds each, in an area of 5620 square statute miles. This estimate was arrived at by taking the largest trustworthy report of the numbers of dead fish given by the numerous captains and dividing it by 400, thus allowing that there was only one fish where 400 were reported to be. This wholesale destruction attracted much attention at the time, and the Fish Commission has since made a careful study of the subject, and although many trials have been made, not a single tile-fish has ever been taken. A few other species of animals have also disappeared from the same bank, and it is the theory that a cold wave of water from the inlying shallower region was driven across the warm bank inhabited by these fish by the strong northerly winds which prevailed at the time. The tile-fish being naturally a delicate fish, was killed by this sudden change of temperature, while less delicate animals survived. Whether they are entirely extinct or not cannot be told. Certain it is that, although many expeditions have been sent out and days spent in search of this fish, not a single specimen has been taken since that great mass of dead fish were found covering an immense area off the American shore. It is by far the most interesting problem as yet studied by the Fish Commission. An interesting history of this fish is given by Captain Collins in the Annual Report of the U.S. Commissioner of Fish and Fisheries for 1882, pp. 237-292, with a figure of the

fish and a map showing the position of the banks and the area covered by the dead fish.

In addition to this branch of the Fish Commission's work, it has been doing a very important service to the country by hatching shad and salmon, and partially re-stocking rivers with these fish. By introducing the German carp to America a work of great economic importance was achieved, and the large number of carp-ponds in America shows the popularity of this new fish. In connection with State Fish Commissions much work is being done, which is of great importance. In every State of the Union there is now a more or less important State Fish Commission, and nearly all have been started since the National Commission, which may be considered to be the father of them all. For several years naturalists of the Fish Commission have been studying the oyster problem, with the hope of in some way protecting them from their natural enemies and preventing their decrease. Under the direction of Mr. J. A. Ryder important experiments upon artificial oyster-farming have attained a marked degree of success, and within a comparatively few years it may be expected that oyster-culture in America will be revolutionised. There are at present experiments in progress upon the transplantation of certain desirable shell-fish from the east coast to the west coast of America. Owing to the extreme difference in character between the water of the two coasts, it is doubtful if these experiments will succeed.

For the purpose of studying the economic problems it is necessary that men be sent to different parts of the American coast, and these men are always instructed to study the fauna and make collections. These collections are all, after careful study by the Fish Commission naturalists, turned over to the United States National Museum, and in this way her zoological collections are vastly increased. The collections made by the Fish Commission steamers are of vast scientific importance, and they greatly add to the interest and value of the zoological branch of the National Museum collection. It is also the plan of the Fish Commission to distribute sets of duplicates from their collections to the different Museums of the country. Nearly 200 such sets have already been distributed, and special sets are made up for exchange with foreign Museums. It has been the policy of the Commission to carefully study American fisheries and the apparatus in use both in this country and abroad, and by this means find out the most improved apparatus and have it adopted in America. It was with this object in view that complete sets of American apparatus were sent to the Exhibitions held at Berlin and London, and that experts were sent to study the foreign exhibits. Already the effects of these studies are being felt in America, and American fishermen, having learned in the past to respect the Commission's advice, are beginning to adopt needed reforms in vessels and outfit. It is hoped that the American exhibits had some similar effect upon the fisheries of other nations.

The Fish Commission's work in its original conception was really the solution of practical economic problems, and it has in the main adhered to this idea. Hence its scientific work has been mainly upon animals which are in some way connected with such problems, the work in very deep-sea dredging being an exceptional but natural deviation from the rather uninteresting study of the shallow fishing-grounds to the rich field of deep-sea research. As this work can be carried on in addition to and without interfering with the regular work of the Commission, there is no chance for complaint. To the scientific world it is very important that this is the case. Dealing with the problems that it has, the natural history work of the Fish Commission has, of necessity, been mainly of a systematic character, dealing with species and their distribution more than with problems of anatomy, embryology, and histology. But there has been also much embryological work, that of Mr. Ryder upon certain economic fish and the oyster being of most importance. In addition to this natural history work, there has been the gathering together of complete collections of all apparatus used in connection with the fisheries, which have been placed in the National Museum. At some future time they will possess an immense scientific value.

The scientific and important practical results of the Commission's work are mainly set forth in the publications of the Fish Commission or the National Museum, but some of the monographs, and also synopses of species, which require better plates than the Government publications ordinarily contain, or need to be published in haste, are printed in some other publications. The Commission publishes an Annual Bulletin and an Annual Report. The former is printed in parts, a few pages at a time, and sent to scientific men as soon as published, and afterwards gathered into volumes. Four have been printed up to date, and they contain miscellaneous articles, many of considerable scientific importance. The Report is published annually, and contains the larger reports upon different questions and general monographs of groups of animals. There are nine volumes already published, and they cover the years of the Commission's work up to 1881. Many of the reports contain articles of great importance to the scientific world.

RALPH S. TARR

THE INSTITUTION OF ENGINEERS AND SHIPBUILDERS IN SCOTLAND

A GREAT amount of valuable scientific work, of a special character, is done by the various engineering institutions of the country; and much of the progress latterly made in the practical applications of science to mechanical operations, and also in the advancement of those sciences which bear most directly upon engineering work, is largely due to the growth of these institutions. The principal one—that of the Institution of Civil Engineers—may be regarded as the parent institution, not only by reason of its age, but also because of its high standing and the quality of its work. The Institution of Civil Engineers has contributed, in a very important degree, towards transforming engineering from the position of a "base mechanical" calling into one which ranks high among learned and scientific professions.

The great success and usefulness of the Institution of Civil Engineers has gradually led to its work becoming more and more differentiated, and to certain special branches of it being taken up by other institutions that have been formed for the purpose. We thus find the Institutions of Mechanical Engineers, Telegraph Engineers, Naval Architects (in which marine engineers are included), the Iron and Steel Institute, and others. All of these institutions are in a prosperous condition, and enrol a large number of new members every year. They have been most successful, without exception, both professionally and scientifically. While, on the one hand, they have benefited their members by collecting papers and providing opportunities of discussion upon points of vital interest to them in the pursuit of their various callings, they have also, on the other hand, carried scientific investigation forward in directions which would otherwise have been much neglected. The field of science—and particularly the inductive side of it—has been greatly extended by the able and thorough—though often unobtrusive—work which has been done by the engineering institutions.

It is not in the metropolis alone, however, that such institutions are now to be found. They supply too universal a want to admit of being centred in any one part of the country. We have just received from Glasgow the twenty-seventh annual volume of the *Transactions* of a well-known and excellent institution which exists in that city, viz. that of the Engineers and Shipbuilders in

Scotland. This Institution is not restricted to the marine or any other special branch of engineering, but includes among its members civil and mechanical engineers of all classes, metallurgists, marine engineers, and shipbuilders. Its published volumes of *Transactions* usually contain papers of a varied and instructive character, and very valuable communications from some of the most eminent Clyde engineers are to be found in them. The importance of this Institution may be judged of by the fact that the number of its members, associates, and graduates amounts to 581.

The volume of *Transactions* just issued contains papers and discussions upon the properties of the compound engine, the stability of ships, screw piles, the testing of turbines, cable tramways, and other subjects. There is also a Presidential Address, delivered by the President, Mr. James Reid, of the Springburn Locomotive Works. Mr. Reid reviews briefly many of the latest engineering achievements that have been recorded, or that are being attempted. He refers to railway operations in this country and abroad, tramways, steam-shipping, docks, harbours, canals, bridges, hydraulic and electrical machinery, gas, and smoke combustion. Where the range of subjects is so varied and extensive, the briefest references are usually of course all that are possible.

Mr. Reid points out, with regard to railway traffic, the beneficial results of lower fares and other increased facilities in not only wonderfully augmenting the volume of third-class traffic, but also in adding, upon the whole, to the receipts of the railway companies. "As the downward movement of classes is still continuing, the outcome will most likely be a general reduction of the number of classes to two—nominally first and third, but practically first and second." The railway companies in this country yet have a most useful work to do in circulating food-supplies. The Fish League have had refrigerator cars constructed, which are working between the Scotch ports and London; and this small commencement is capable of a very large and urgently-needed development. A new departure in locomotive practice has been taken by M. Anatole Mallet in France, and by Mr. F. W. Webb in England, by compounding the engines. The results thus obtained are stated to be very satisfactory, although the maximum economy that is practically possible can of course only be obtained by steam-jacketing the cylinder, or by the use of superheated steam.

The advances that have recently been made in steam-shipping are referred to. The fastest voyage made by any steamer prior to October 23, 1883, was that of the *Alaska*, in which she ran 2784 miles, between Queenstown and New York, in 6 days, 21 hours, and 40 minutes. Mr. Reid says that this is equivalent to a mean speed of 17 miles per hour; but he speaks of miles in connection with these figures as though he were dealing with ordinary statute miles. The figures given really relate, however, to knots, or nautical miles, so that the speed of the *Alaska* upon the voyage in question was at the rate of over 19½ miles per hour. Mr. Reid also says that at an average speed of 19¼ miles per hour the Atlantic might be traversed in six days. The average speed requisite for crossing the Atlantic in six days is about 19½ knots, or 22½ miles, per hour, a speed which nearly amounts to that of many ordinary railway trains.

The performance of the *Alaska*, which Mr. Reid refers to, has been much exceeded during the present year by two Atlantic liners, the *Oregon* and the *America*. The *Oregon* has crossed the Atlantic in less than 6 days, 10 hours, thus beating the *Alaska* by nearly half a day. The *Umbria* and *Etruria*, the new vessels of the Cunard Company, are expected to beat the *Oregon* by about as much as the latter beat the *Alaska*. The *Umbria* is said to have attained, upon the measured mile, a mean speed of 20½ knots, or nearly 24 miles per hour. It is possible that she may succeed in crossing the Atlantic in six days.

Passing from the wonderful strides thus making in steam-shipping, the President calls attention to the chief of the large canal schemes which are now before the world, such as the Panama Canal—which the indomitable energy of M. de Lesseps appears likely to bring to successful completion—an independent canal across the Isthmus of Suez, and the Manchester Ship Canal. It is surprising, however, that, while referring to these various means for facilitating transit across the ocean, and also to the Channel Tunnel, Mr. Reid omits to notice the ship-railway scheme of the American engineer, Capt. J. B. Eads, C.E., which has now been for some time before the engineering world, and has received the approval of some of the most eminent authorities.

The principal papers contained in the volume of *Transactions* under notice are those upon the compound engine viewed in its economical aspect, by Mr. R. L. Weighton; upon the stability of ships at launching, by Mr. J. H. Biles; and on approximation to curves of stability from data for known ships, by Messrs. F. P. Purvis and B. Kindermann. Mr. Weighton's paper gives a clear and able explanation of some of those properties of the compound engine which affect its economical working; and while there is nothing novel or recondite in it, and it is somewhat amateurish in style, it is of value in keeping before the minds of engineers points of fundamental importance which it is well for them to think precisely and frequently about; and it did good service in causing one of the longest and most interesting discussions which took place during last year's meetings. We dissent entirely from an opinion expressed by one of the speakers, that "papers brought before an Institution of this kind should either expound some new theory, contain some novelty, or bring before them some important addition to the mechanical details of any machine." An exclusive striving after mere originality is not an unmixed good; besides which, one of the greatest advantages of such institutions as that of the Engineers and Shipbuilders in Scotland is that the members become familiarised by papers and discussions which are even of a commonplace type with what is already known and thought by the most capable men upon subjects that all engineers require to thoroughly master. It is not novel points nor original conceptions only which are of value to the rank and file of members; a still more potent cause of good is to be found in the educating and informing influence which is exerted by well-established scientific ideas and recorded experience being frequently discussed, and by the constant and ready reference to fundamental and accepted principles which this involves.

The paper on the stability of ships at launching is accompanied by curves for various types of steamer at launching-draught, and advocates constructing such curves, as a rule, before launching ships. It is well worth reading, as it, and the discussion upon it, show how diverse and inconsistent though, on the whole, vague are the views held by many shipbuilders, both upon the necessity for ascertaining the precise degree of stability possessed by a ship, and also as to the sufficiency of a given amount of stability for purposes of safety. The author is somewhat ambiguous and inaccurate in his definitions of such terms as "stability," "stiffness," &c., and inconsistent and loose in his use of them: but this appears to be a common fault with technical writers upon naval architecture, as was pointed out by Prof. Osborne Reynolds at the British Association meetings of last year. For instance it is stated in the paper under consideration that "the kind of stability which is required at launching is stiffness," and "the question of stability at launching appears therefore to reduce itself to one of stiffness,"—stiffness being represented by the metacentric height, which measures the force required to incline a given vessel through small angles from a position of rest in still water. Yet the author goes on to say that "our only safe guide is the

complete investigation of the stability of a ship at angles considerably beyond those to which the metacentric height is a fair measure of the stiffness." He also speaks of the "stability of a ship up to 60° of inclination." This is a strange although common misuse of the term "stability." Stability only exists at a position of stable equilibrium, and what is really meant by the above-quoted sentence is not stability at large angles of inclination, but *righting force*.

The other paper upon stability, which describes a method of approximation to curves of stability from data for known ships, is interesting in showing how some of the elements of stability vary in a ship with the ratios of draught of water to depth, and depth to breadth; but we cannot regard it as likely to be of much value in practice. The approximations obtained by applying the method are only reliable when the form of the vessel for which the curve of stability is required, and that of the one which is being used for estimating it from, are so related to each other that any section of the one may be obtained by projection from the corresponding one of the other. Differences in form are excessively numerous—almost universal indeed—among ships; and small discrepancies of such a kind often affect stability to an important degree. When vessels are found to belong to what is defined in the paper as a "type-form," the method is applicable, but where no true type-form can be discovered for a particular ship—and this is what usually happens in practice—the only reliable and also the readiest mode of approximation to a curve of stability is to compute by means of Amsler's integrator the true length of a small number of ordinates of the curve.

There are other papers of interest in this volume which are amply deserving of perusal, though we have not space for referring in detail to them. We may note, however, as an indication of the active and enlightened interest taken by Scotch engineers in scientific teaching, that the President of the Institution of Engineers and Shipbuilders in Scotland—in referring at one of the meetings to the endowment of the John Elder Chair of Naval Architecture in Glasgow University, which is filled by Prof. F. Elgar—said that "the Council had agreed, and were morally bound, to support the institution of a lectureship in anticipation of a Chair of Naval Architecture in the University." Mr. Reid further stated that "the Council had agreed to continue the lectureship in connection with the Chair," and he wished it to be known that the original intention was still to be carried out. This is a strong practical proof of the earnestness and wise liberality of Scottish engineers in the matter of scientific and technical education, and it is a policy which cannot fail to largely benefit the district in time to come. It is also one indication, out of many, of the advantages which may confidently be looked for by engineers and scientific men as the natural outcome of such institutions as those we have referred to.

THE EGGS OF MONOTREMES

SPEAKING at the anniversary meeting of the Royal Society in November 1883, Prof. Huxley said:—"It certainly was high time that British science should deal with a problem of the profoundest zoological interest, the materials for the solution of which abound in, and are at the same time confined to, those territories of the Greater Britain which lie on the other side of the globe." These words had reference to the series of investigations which Mr. Caldwell—the first Balfour Student—had then gone to Australia to prosecute with regard to the embryology of the lowest Mammalian forms, the Monotremes and Marsupials.

Somewhat less than a year later, and whilst the British Association was holding its meetings in Montreal, Prof. Moseley, the President of the Biological Section, was enabled to communicate the following brief but suggestive message telegraphed from Australia:—"Caldwell finds Monotremes oviparous; ovum meroblastic." Brief as was the message, it yet, as Prof. Moseley said, contained the most important scientific news which had been communicated to the Association in Canada.

Zoologists will now look forward with deep interest to the publication of Mr. Caldwell's more detailed account of his recent investigations, which have apparently enabled him to confirm so fully what has before been suspected, but never actually proved to be the case.

That Monotremes are oviparous has been maintained by various naturalists for now some sixty years: but up till the present time no sufficient evidence has been brought forward to place the matter beyond dispute, the chief difficulty in elucidating the problem lying in the fact that the two curious groups of animals which alone are placed in the Monotremata inhabit exclusively the Australian region, and hence have been but little studied in their natural habitat.

Though they are closely allied, yet the Ornithorhynchus and Echidna differ markedly from each other in external appearance—the one being adapted to the water, having its feet webbed, and its muzzle of that peculiar shape which has earned for it the name of Duck-billed Platypus, whilst the other is essentially a land animal, feeding on ants which it licks up by means of a long flexible tongue, and having its body covered with sharp spines, much as a hedgehog.

The question of how these animals reared their young, and in what condition the latter were born, has long been a matter of much dispute, and for information we are principally indebted to the memoirs of Home, Meckel, Geoffroy St. Hilaire, and perhaps most of all to Owen; whilst from time to time short notices are to be found in the *Proceedings* of the Zoological Society and the *Journal* of the Linnean Society.

In 1829 Geoffroy St. Hilaire laid a communication before the Royal Academy of Sciences in Paris, entitled "Considérations sur les œufs d'Ornithorinque formant de nouveaux documens pour la question de la classification des Monotrêmes."[1] Herein he stated his opinion that the Monotremes could no longer be admitted amongst the mammals, nor could they be classified with either birds, or reptiles, or fishes, but they must, though including only two groups of animals, be formed into a distinct fifth class among the Vertebrata, which would hence be divided, according to him, into Mammals, Monotremes, Birds, Reptiles, and Fishes.[2] The most interesting part of his paper, from our present point of view, however, consists of a letter which he quotes in full from Prof. Robert E. Grant of London, who describes in some detail the finding by a certain Mr. Holmes, whilst shooting on the banks of the River Hawksburgh in Australia, of a nest of eggs laid by an Ornithorhynchus; the animal was seen to hasten away from a sandy bank and plunge into the water. Examination of the bank led to the discovery of a small burrow, in which, on a rude nest made of twigs, were deposited nine eggs of a peculiar shape and size, which rendered them clearly distinguishable from those of any bird. The eggs, he says, are remarkable "par une forme régulière sphéroïdale oblongue, par une égale largeur à chaque bout; ils ont (mesure anglaise), en longeur de pouce, $1\frac{3}{8}$, et en largeur $0\frac{8}{8}$; la coquille est mince, fragile, légèrement transparente, et d'une couleur uniforme d'un blanc mat; sa surface extérieure, vue à la loupe, présente une texture d'un réseau admirablement réticulé; la matière calcaire a produit les parois blanches de ses innombrable et très-petites cellules, ce qui n'empêche pas que la surface n'en demeure à peu près polie.

[1] *Annales des Sciences Naturelles*, t. xviii. p. 162; also *Bulletin de la Société Philomathique*, t. viii. p. 95.

[2] The same idea is to be found also in Lamarck, *Philosophie Zoologique*, t. i. p. 145. Lamarck adds, further, "Ce ne sont point des mammifères; car ils sont sans mamelles, et très-vraisemblablement ovipares."

Un des œufs était cassé, et j'en ai examiné la surface interne, laquelle m'a paru être aussi formée par un dépôt de très-petits grains de la matière calcaire." He further states that the dimensions and form of these eggs remind him of those of many of the Saurian reptiles and Ophidians; whilst Jarrel, who examined them, came to the conclusion that they differed as much from the eggs of birds as from those of reptiles.

Fig. 1 is copied from a drawing which accompanies the paper of Geoffroy St. Hilaire, and represents its actual size and form.

Of the nine eggs which were discovered in the nest four were brought to England, and of these two found their way to the Manchester Museum, where, Prof. Williamson has kindly informed me—whilst he was curator, from 1835 to 1838—he distinctly remembers

FIG. 1.

their being placed and labelled as "eggs of Duck-billed Platypus."

In 1826 Meckel, of Halle, had published a monograph on *Ornithorhynchus paradoxus* (Leipzig, 1826), wherein he announced the discovery of mammary glands, rudimentary in condition, but still undoubtedly present, and serving for the nutrition of the young; Geoffroy St. Hilaire, who, as before said, was strongly of opinion that the Monotremes could not be included amongst the Mammalia, suggested that the nature of these glands had not been sufficiently studied, and that instead of being mammary they were very probably analogous to those spread out on the flanks of aquatic reptiles, and which served to lubricate the skin; if this were not the case, he further suggested a comparison between them and certain odoriferous glands existing in the neighbourhood of the mammary glands in shrews.[1]

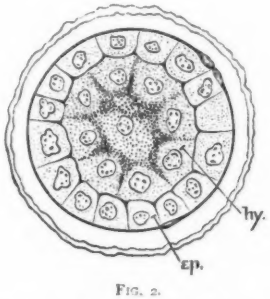

FIG. 2.

To these criticisms Meckel urged in reply the strong argument that they were only known to exist in female Monotremes, the males possessing no such structure, and later still Owen published his account of the "Mammary Glands of *Ornithorhynchus paradoxus*" (*Phil. Trans.* 1832). In this paper also he quotes the following passage from Meckel ("*Ornithorhynchi paradoxi* Anatome," p. 58):—"The difference between the bringing forth of living young and of eggs is really very small, and by no means of an essential nature: birds have accidentally hatched the eggs within the abdomen, and so produced a living fœtus—an occurrence which has been induced by direct experiment; and lastly the generation of the Marsupial animals is very similar to the oviparous mode." Meckel, Owen says, deems it "very probable that as the Ornithorhynchus approaches still nearer than the Marsupials to birds and reptiles, its mode of generation may be in a proportionate degree analogous."

Somewhat later Owen published an account of an Ornithorhynchus fœtus,[1] which measured only two inches in length. After describing its external appearance he says, "On the middle line of the upper mandible, and a little anterior to the nostrils, there is a minute fleshy eminence lodged in a slight depression. In the smaller specimen this is surrounded by a discontinuous margin of the *epidermis*, with which substance therefore, and probably (from the circumstance of its being shed) thickened or horny, the caruncle had been covered. It is a structure of which the upper mandible of the adult presents no trace, and is obviously analogous to the horny knob which is observed on the upper mandible in the fœtus of some *birds*. I do not, however, conceive that this structure is necessarily indicative of the mandible's having been applied, under the same circumstances, to overcome a resistance of precisely the same kind as that for which it is designed in the young *birds* which possess it. The shell-breaking knob is found in only a part of the class, and although the similar caruncle in the Ornithorhynchus affords a curious additional affinity to the *Aves*, yet as all

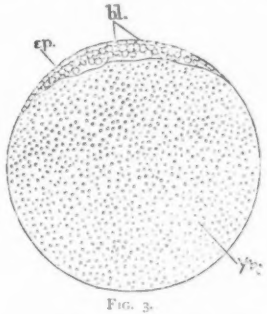

FIG. 3.

the known history of the ovum points strongly to its ovo-viviparous development (see also *Phil. Trans.*, 1834, p. 555), the balance of evidence is still in favour of this theory."

Later still (*Phil. Trans.*, 1865, p. 671) he published a paper on the "Marsupial pouches, mammary glands, and mammary fœtus of the *Echidna hystrix*," wherein he proved that the same caruncle was present in the Echidna fœtus, and further that this was carried about by the mother in a pouch (two being present in each individual, one on either side the middle ventral line), into which opened the mammary glands.

Owen adheres firmly to the opinion that the Monotremes are ovo-viviparous, in which opinion he is supported by the evidence of, amongst others, Sir E. Home (*Phil. Trans.*, 1802, p. 67), whose account is probably the earliest notice of any detail, which was published in England with regard to the internal anatomy of Ornithorhynchus.[2] Home says at the close of his paper, "this animal having no nipples and no regularly formed uterus, led me to examine the female organs in birds to see if there was any analogy between the oviducts in any of that class and the two membranous uteri of this animal;

[1] *Proc. Zool. Soc.*, 1833, pp. 28 and 91; also, "Memoir on the Abdominal Glands of Ornithorhynchus, falsely presumed to be mammary, but which secrete, not milk, but mucus, destined for the first nutriment of the young when newly hatched," *Gazette Médicale*, February 18, 1833; also, *Annales des Sciences Naturelles*, tom. lx. p. 457.

[1] *Trans. Zool. Soc.*, vol. i. p. 222; also *Proc. Zool. Soc.*, 1834, p. 43.

[2] For one of the earliest figures, see Shaw's *Naturalist's Miscellany*, vol. lx. 1799, and for figure of Echidna *vide op. cit.* vol. iii. 1792, under name of *Myrmecophaga aculeata*. Shaw says of Echidna, "It is also a most striking instance of that beautiful gradation so frequently seen in Nature, by which creatures of one tribe or genus approach to those of a very different one. It forms a connecting link between the very distant genera of Hystrix and Myrmecophaga; having the external aspect of the one with the mouth and peculiar generic characters of the other."

but none could be observed, nor would it be easy to explain how an egg could lie in the vagina to receive its shell, as the urine from the bladder must pass directly over it. Finding they had no resemblance to the oviducts in birds, I was led to compare them with the uteri of those lizards which form an egg that is afterwards deposited in a cavity corresponding to the uterus of other animals where it is hatched; which lizards may be therefore called ovo-viviparous, and I find a very close resemblance between them."

There has been, however, a certain amount of direct evidence brought forward beyond that which has been quoted from Geoffroy St. Hilaire's paper to prove that Monotremes are really oviparous, notwithstanding the fact that they nourish their young by means of mammary glands.

Thus a Dr. Nicholson (*Phil. Trans.*, 1865, p. 683), writing to Owen in 1865, informs him that a Platypus had been captured by workmen on the banks of the River Goulburn in Victoria, and had been placed for a night by the gold-receiver of the district, to whom it had been handed over, in a wooden case, and that whilst in confinement it had laid two eggs—white and soft, with no calcareous covering, and about the size of a crow's egg. Dr. Nicholson does not, however, appear to have taken the trouble to examine the eggs at all carefully, and his evidence is rejected by Owen as certainly insufficient to make him doubt that the Monotremes are ovo-viviparous.

Earlier still in Messrs. Lesson and Garnot's "Voyage de la Coquille" (*Zool. Journal*, vol. v.), it is stated that the colonists assured the travellers that Ornithorhynchus was oviparous, whilst a Mr. Murdoch, superintendent of the farms on Emu Plains, said that he himself had seen the eggs, that they were two in number, and the size of a hen's egg.

Again, Dr. Weatherhead (*Proc. Zool. Soc.*, 1832, p. 145) read, before the Zoological Society in 1832, extracts from a letter received by himself from Lieut. Maule in New South Wales, wherein the latter describes in some detail the finding and unearthing of an Ornithorhynchus burrow. The entrance to the latter, he says, is beneath the water, though, after some little distance, the passage rises, and, after a few yards have been traversed, it "branches into two others, which, describing each a circular course to the right and left, unite again in the nest itself, which is a roomy excavation lined with leaves and moss, and situated seldom more than twelve yards from the water or less than two feet below the surface of the earth: several of these nests were with difficulty discovered. No eggs were found in a perfect state, but pieces of a substance resembling egg-shell were picked out of the debris of the nest. In the insides of several Platypi which were shot were found eggs of the size of a musket-ball and downwards, imperfectly formed however, *i.e.* without the hard outer shell, which prevented their preservation."

Dr. Bennett also (*Proc. Zool. Soc.*, 1859, p. 213) investigated the structure of the Monotremes and examined the nest of Platypus, but failed to find traces of eggs.

Lastly, Mr. Patrick Hill, surgeon in the Royal Navy, published in *Trans. Linn. Soc.*, xiii. p. 621, information which had been brought to his notice concerning the Monotremes whilst studying their nature and habits in the district around Sydney. A female specimen was brought to him which had been taken directly from its nest, but which died very soon after being placed in confinement. On opening the body he discovered in the left ovary a round yellow ovum about the size of a small pea and two of smaller size, whilst no trace of ovisac was to be found in the right ovary;[1] but beyond his own investigations he brings forward the evidence of a certain Cookoogong, chief of the Boorah-Boorah tribes, who, as is quaintly remarked in Geoffroy St. Hilaire's article, "ne manquait ni de lumière ni de moralité." This native chief stated that it was a fact well known to their tribe that the animal lays two eggs, about the size, shape, and colour of those of a hen, and that the female sits a considerable time on her eggs in a nest which is always found among the reeds on the surface of the water; the native name for the Platypus, he added, was Mullingong.

The most important part of Mr. Caldwell's communication to the British Association was, however, contained in the two words "ovum meroblastic"; in other words, the ovum of a Monotreme contains, relatively to the pure protoplasm out of which the tissues of the animal will be formed, so much food-yelk that, when segmentation takes place, it is impossible for the egg to segment as a whole, and therefore the two kinds of protoplasm separate, and we find that the Monotreme embryo possesses a yelk-sac, by the gradual absorption of the contained material of which it is nourished during the early stages of development.

The presence of so large an amount of food-yelk thus renders it unnecessary that during this period the tissues of the embryo should enter into such a close relation with the maternal ones as is found to obtain in the rest of the Mammalia, though even amongst the higher members of the latter there are certain signs which point to a former period in their phylogenetic history when they also were possessed of a yelk-sac.

Figs. 2 and 3 represent respectively examples of holoblastic and meroblastic ova at very early stages, the one being that of a rabbit, the other that of a Sauropsidan, and it is to the latter that the ovum of Monotremes bears a close resemblance.

In both cases it is interesting, however, to observe that a structure is eventually formed known in birds and reptiles as the yelk-sac and in most mammals as the umbilical vesicle, the two being really homologous with each other.

Now that Mr. Caldwell has shown that in the lowest mammals a yelk-sac is present containing food-yelk instead of an umbilical vesicle as in the higher forms, it may be affirmed that the curious stages in the development of most Mammalia which result in the pinching off of the embryo and the formation of an umbilical vesicle are indications still remaining of the time when these animals were nourished during early stages, not directly by a close union with the maternal tissues, but by means of yelk-sacs: it affords evidence, in fact, that their ancestors were not viviparous, but oviparous, just as are the lowest mammals now known to us.

During late years various theories have been held concerning the origin of mammals: Balfour formed a hypothetical group—the Pentadactyloidei—in which he supposed the pentadactyle limb characteristic of all the higher vertebrates to have been established: from this he derives two groups—the one including the present existing Amphibia, the other being a hypothetical and somewhat generalised group, from which, though along divergent lines, were developed both Mammalia and Sauropsida. Thus, according to him, the two latter were branches from one common stem, but the Sauropsida could not be considered as the ancestor of the Mammalia.

Other scientific men have held that mammals were derived from Amphibia-like ancestors: with the present Amphibia they were supposed to agree in the presence of a holoblastic ovum, and in the important fact that in both groups two occipital condyles are present, whilst only one is typically found in the Reptilia.

It is interesting to notice that Cope has described, amongst the numerous extinct forms of reptiles which he has brought to light during the past few years, one, called by him the Theromorpha (*Proc. Am. Phil. Soc.*, vol. xix.

[1] See also Owen, "Anat. of Vert.," vol. iii. p. 676; also *Proc. Zool. Soc.*, 1834, p. 143.

p. 38), which he regards as intermediate between Reptilia and Mammalia. He says:—"The order Theromorpha approximates to the Mammalia more closely than any other division of Reptilia. This approximation is seen in the scapular arch and humerus, which nearly resemble those of the Monotremata, especially Echidna; and in the pelvic arch, which Owen has shown in the sub-order Anomodontia to resemble that of the mammals, and, as I have shown, especially that of Echidna. The tarsus is also more mammalian than in any other division of reptiles. In the genus Dimetrodon the coracoid is smaller than the epicoracoid, as in Monotremes. The pubis has the foramen for the internal femoral artery." Cope also appears to have found in the Theromorpha a spur attached to the hind foot, just as in the males of Monotremata.

In the skeletons of the latter, on the other hand, we find several prominent features in which, whilst they differ from the typical mammalian forms, they approximate more or less closely to the reptiles, whilst finally Mr. Caldwell's discovery with regard to the nature of the ovum has shown that Mammalia and Sauropsida are closely allied to each other—more intimately than has generally been allowed by naturalists.

In Monotremes we find, as it were, intermediate animals possessing the attributes of two classes: whilst on the one hand they have developed mammary glands, the distinctive feature of the higher group, on the other they lack that structure whereby the typical mammalian embryo receives nourishment before birth; and in correlation with this we find them agreeing with the lower class in the possession of a yelk-sac, whilst the contained food-yelk causes the ovum to assume the meroblastic type.

We may thus trace the line of descent through the Sauropsida directly to the Monotremes (doubtless through forms now extinct, as the Theromorpha of Cope); from these to Marsupials, which are indeed viviparous, but whose ova still possess a large yelk-sac, and whose embryos, as Mr. Caldwell (*Q.J.M.S.* October 1884) has just shown, enter into no close vascular connection with the maternal tissues; and from these to the higher mammals, whose much specialised structures for fœtal development differ now so widely from those of the lower vertebrates.

W. BALDWIN SPENCER

NOTES

LAST Thursday (December 4) the Chemical and Physical Society of University College, London, gave a scientific *soirée* in connection with the University College Society. Prof. T. G. Bonney delivered the annual address, and took as his subject "Serpentine Rock and its Origin." The lecture was illustrated by Wright and Newton's new oxy-hydrogen microscope. During the evening demonstrations were given on "Radiant Matter" by Mr. Rose Innes, "Absorption Spectra" by Mr. Schunck, and "Ozone" by Mr. E. E. Craves, in various parts of the building. In the library were exhibited by several gentlemen and manufacturers new scientific apparatus and chemical compounds. The physical and chemical laboratories were thrown open to visitors, and in them were shown new forms of apparatus for research. The meeting was numerously attended, and the committee are to be congratulated on the success of the evening.

THE ordinary general meeting of the members of the Parkes Museum was held on Thursday, December 4, Capt. Douglas Galton, C.B., F.R.S., in the chair. The meeting was held to consider the report of the Council for the tenth year and to elect officers. The report set forth the work done in connection with the Museum during the past year, which had included lectures by the Council of the Sanitary Assurance Association in addition to those arranged by the Council of the Museum. The accounts showed that there was urgent need for increased subscriptions if the Museum was to be continued, for the small invested capital had had to be made use of this year to meet the current expenses. The report was adopted on the motion of the Chairman, seconded by Mr. Rogers Field. Mr. Mark H. Judge, then proposed "That the report be printed for circulation, with a detailed statement of the financial position of the Museum, and that a special meeting of the members be convened within two months to consider the same." This was seconded by Mr. E. C. Robins, and carried unanimously. Sir R. Lloyd Lindsay, Prof. J. Marshall, F.R.S., and Mr. Alfred Waterhouse, A.R.A., were elected Vice-Presidents. Six new Members of Council were elected, and the meeting closed with a vote of thanks to the Chairman, proposed by Dr. J. C. Steele of Guy's Hospital.

WE have before us a most satisfactory report of the Manchester Public Free Libraries for 1883-84, showing increase everywhere. More than one and a quarter million of issues have been made to two and a half million of visitors to the libraries. Of these the boys have been provided with additional reading-rooms to themselves, which are reported as crowded every evening; the increased Sunday issues of books also are noted as being specially made to boys, and it cannot be doubted that a taste for reading thus early implanted will save them from half the temptations to which idle youth is subjected. While nearly 10,000 new books have been purchased, more than 10,000 have been started in new harness for fresh toil by the bookbinder; and few items can speak better of "something accomplished, something done," than 3325 volumes withdrawn from circulation, simply worn out. At one branch a new catalogue published, at another one preparing, and at a third two supplementary lists issued, keep the value and the availability of the books at the highest point.

AT the meeting of the Geologists' Association last Friday, Mr. R. Meldola gave a preliminary account of his investigation of the East Anglian earthquake of April 22, 1884, with special reference to the geology of the question. The extreme limits of the recorded disturbance were Brigg in Lincolnshire, Altrincham in Cheshire, Worcester, Bristol, Street (Somersetshire), Boulogne, and Ostend, giving in round numbers an area of 50,000 square miles. The focus of the disturbance appears to have been beneath the earth near the villages of Abberton and Peldon, between Colchester and Mersea Island, and there seems to have been total reflection of the shock at Wivenhoe on the River Colne, the tract of country to the north-east of this village, where great damage was sustained, being in "seismic shadow." The area of structural damage comprised about fifty or sixty square miles, the main axis being along a line five miles in length and extending in a S.W.-N.E. direction from Peldon to Wivenhoe. The evidence showing the propagation of the shock along the older rocks had been carefully considered, and the conclusion had been arrived at that such a spreading of the shock towards the west, north-west, south-west, and south-east had actually taken place, an additional argument in favour of the extension of the Palæozoic rocks beneath the south-east of England, as first suggested by the late Godwin-Austen in 1855, being thus furnished. It was pointed out that this extension of the disturbance along the older rocks was of a purely dynamical character, depending simply upon the superior elasticity of these formations. One phase of earthquake movement which the present disturbance appears to have revealed with special distinctness was the tendency of the shock to make itself felt along free margins such as coast-lines, river-valleys, lines of outcrop, &c. The general conclusion respecting the distribution of earthquakes in this country which the present investigation

had led to was that earthquakes having their focus in the east of England would be likely to extend much further west than those originating in the west would extend eastwards, this depending upon the geological structure of the country and being supported by the records of previous British earthquakes, of which a complete catalogue was in course of preparation. Mr. Meldola stated that the complete report, which was very voluminous, was nearly ready for publication.

WITH reference to the palæontological discovery of a fossil scorpion in the Upper Silurian formation of Gothland, recently made by Prof. G. Lindström of the Academy of Sciences, Stockholm, which has attracted considerable attention on the Continent, we have received the following communication from this *savant*:—"The discovery was made in the latest Upper Silurian layer. Only the thin chitinous coat has been preserved, all the soft membranes having decayed, and the body is compressed, owing to the pressure of the superincumbent layers. Like the scorpions existing at the present time, its body consists of the cephalothorax, seven abdominal membranes, and seven segments in the tail, of which the seventh is distinctly shaped into a poisonous sting. Both the great claws (*palpi*) still remain; the number of legs was eight, those of the left side being in perfect condition. They differ entirely from all known scorpions, fossil or living, by the joints being thick and heavy and the leg ending in a point instead of claws. There is a marked respiratory cavity (*stigma*) on the right side, from which I draw the conclusion that it was not only an air-breathing animal but an animal living on *terra firma*. Its whole construction points to this. It is the oldest known land-animal, the limits of our knowledge as to its existence during past ages having been extended from the Middle Devonian strata of Canada, where remains of Neuroptera have previously been found, to the uppermost strata of the Upper Silurian formations."

THE Mersey Tunnel is now completely arched in under the river with the exception of the inverts. It is interesting to geologists to know that, about three hundred yards from the Liverpool side, the upper part of the tunnel intersected the pre-Glacial bed of the river for a distance of about one hundred yards. This "gully" in the rock was filled with hard Boulder-Clay, with erratic boulders resting upon the hard denuded surface of the Triassic sandstone. As showing the importance of a knowledge of geology in engineering works, this pre-Glacial gully was, in opposition to the prevailing opinion, foreseen and predicted as one of the difficulties that would have to be encountered in the tunnel-works in a paper by Mr. Mellard Reade, entitled "The Buried Valley of the Mersey," published in the *Proceedings* of the Liverpool Geological Society in 1872. It is very satisfactory to know that this difficulty is now surmounted, and the stability of this important and interesting work placed beyond a doubt.

As we anticipated some weeks ago, M. Joseph Bertrand has been elected a Member of the Académie Française almost without opposition, having obtained twenty-five votes out of a total of twenty-six, the single dissentient voice having been given in favour of a poet who could hardly be termed a candidate. M. Bertrand's formal reception into the Academy will take place in the course of a few months, and M. Pasteur is to reply to the speech he will deliver on the occasion.

M. JANSSEN is at present engaged in drawing up for the Academy of Sciences a full report of his mission to the Prime Meridian Congress at Washington. He is also to deliver a lecture on the subject before the Geographical Society of Paris. The learned astronomer still adheres to his scheme of a neutral meridian.

MANY of our readers are aware that when Mr. Thiselton Dyer, more than ten years ago, introduced at South Kensington a system of instruction in botany based on the same principle as the instruction in animal morphology already introduced by Prof. Huxley, he intended to put together the results of his experience in the form of a hand-book for the use of other teachers. Pressure of other work prevented his carrying out his intention, but Mr. F. O. Bower, now Lecturer in Botany in the Normal School of Science, took the task in hand in conjunction with Dr. Sydney Vines, and we are glad to be able to announce that Messrs. Macmillan and Co. will publish a first instalment of the work immediately. When complete, according to the original scheme, the work is intended to contain a general introduction by Mr. Dyer, introductory chapters on methods and on the morphology of the cell by Dr. Vines, and then the description of a series of types representing the various groups of the vegetable kingdom. In each case a short general description will precede the directions for investigating the type in the laboratory. The instalment now promised will contain an explanatory preface by Mr. Dyer, the two introductory chapters by Dr. Vines, and the directions for laboratory work on vascular plants, as represented chiefly by the following types:—*Helianthus annuus*, *Ulmus campestris*, *Zea Mais*, *Pinus sylvestris*, *Selaginella Markensii*, *Lycopodium claratum*, *Aspidium Filix-mas*, and *Equisetum arvense*. It is hoped to publish the laboratory directions for the remaining types, and the short prefaces to each type, before very long. For the laboratory directions Mr. Bower is mainly responsible; the descriptive prefaces will be contributed by Mr. Dyer; but the whole work will have undergone the minute supervision of all the three authors concerned, and represent their united experience.

MESSRS. MACMILLAN AND CO. promise immediately an abridged edition, for popular use, of the "Life of Prof. J. Clerk Maxwell."

THE following are the lecture arrangements at the Royal Institution before Easter 1885:—Six lectures (adapted to a juvenile auditory) by Prof. Tyndall, on the Sources of Electricity, on December 27 and 30, 1884, January 1, 3, 6, and 8, 1885; five lectures by Prof. H. N. Moseley, on Colonial Animals, their Structure and Life-Histories, on Tuesdays, January 13 to February 10; four lectures by Dr. Arthur Gamgee, on Digestion, on Tuesdays, March 3 to 24; eleven lectures by Prof. Dewar, on the New Chemistry, on Thursdays, January 15 to March 26; three lectures by Dr. Waldstein, on Greek Sculpture from Pheidias to the Roman era, on Saturdays, January 17 to 31; three lectures by Mr. G. Johnstone Stoney, on the Scale on which Nature works, and the Character of some of her Operations, on Saturdays, February 7 to 21; and five lectures by Mr. Carl Armbruster, on the Life, Theory, and Works of Richard Wagner (with illustrations, vocal and instrumental), on Saturdays, February 28 to March 28. The Friday evening meetings will begin on January 16, when Prof. Tyndall will give a discourse on Living Contagia.

THE archæologist M. Saillard, well known through his indefatigable efforts for the preservation of dolmens, has discovered the workshop of a prehistoric armourer or smith on a steep rock by the sea on the south-west side of the peninsula of Quibéron (Brittany). It dates from the Stone Age. Polished lances, arrow-heads, axes, and other objects are represented in great numbers and in every stage of manufacture, so that the discovery is most interesting, inasmuch as the objects illustrate the workman's method and process. Amongst the objects is also a meteoric stone worked into an implement. The skeleton of the workman was also found, the skull being very well preserved.

DR. AUGUSTUS VOELCKER, F.R.S., died on Friday last, the 5th inst., at his residence, 39, Argyll Road, Kensington, in his sixty-second year. He was born at Frankfort-on-the-Maine,

received his chief education at the University of Göttingen, and in early life came to England. After that time he successively held the post of assistant to the late Prof. Johnston at Edinburgh, Professor of Chemistry in the Royal Agricultural College at Cirencester, and Professor of Chemistry to the Royal Agricultural Society of England, and was well known as the author of several works in theoretical and agricultural chemistry, such as the "Chemistry of Food" and the "Chemistry of Manure."

THE *Journal of Botany* for December contains a memoir of the late George Bentham, accompanied by an excellent photograph.

WE have received the prospectus of the Royal Agricultural College, Cirencester, issued during the past month. The course of instruction provided in technical and scientific subjects appears to be ample for the requirements of the agricultural students. We are glad to notice that external examiners are appointed for the final examination of students for the diploma, and also that a Board of Studies, in which are several professors otherwise unconnected with the College, exists. The number of students is steadily increasing, and among them are several Indian scholars sent by the Governments of Bengal and the North-West Provinces. The Governments of the Indian Presidencies also encourage some of their civil servants to pass through the College course when on leave of absence in this country.

ON the subject of agricultural education, a correspondent writes to the *Times* that a number of meetings have recently been held in Oxfordshire and Buckinghamshire with a view to the establishment of night classes during the winter for teaching the scientific principles of agriculture. There is, he says, a growing opinion among the more educated young men that agriculture requires something besides Commissions and inquiries and fair trade. It has been estimated that the annual waste from careless and unskilful methods of managing manure amounts to nearly five millions sterling. Add to this the want of knowledge in the purchase of artificial manures and their application, the waste of feeding-stuffs, the odd pieces and corners of fields that might grow other things beside rank weeds and couch-grass, and the waste of time in going to markets, auctions, and fairs. No reduction of rent or local taxation, or increased price of wheat, will, says this correspondent, do anything for men who make no effort to improve their industry by increased scientific knowledge. The natural history of the wire-worm, the leather-jacket, the dissolving of bones, the building up of plants, the judicious mixing of food, and many other things which farmers would be the better for knowing can never be acquired by what is called practical farming, and accordingly these classes are commended to the consideration of all who take an interest in the welfare and education of young men in rural districts.

THE additions to the Zoological Society's Gardens during the past week include a Yellow Baboon (*Cynocephalus babouin* ♂), a Chacma Baboon (*Cynocephalus porcarius* ♀) from the East Coast of Africa, presented by Capt. Edward Jones, R.N.R.; a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. Geo. Airey; a Bittern (*Botaurus stellaris*), British, presented by Mr. Robert Page; a —— Otter (*Lutra* ——) from South America, a Cat Fish (*Amiurus catus*) from North America, deposited; two Rock Pipits (*Anthus obscurus*), British), a Passerine Owl (*Glaucidium passerinum*), a Crested Titmouse (*Parus cristatus*) from Siberia, purchased.

OUR ASTRONOMICAL COLUMN

WOLF'S COMET.—Herr Lehmann-Filhés of Berlin has made a first approximation to the amount of perturbation experienced by this comet at its near approach to the planet Jupiter in 1875, to which attention was directed in NATURE (vol. xxx. p. 615). He adopts the orbit determined by Prof. Krueger upon observations extending over an interval of forty-eight days, and applies the formulæ of the "Mécanique Céleste" (liv. ix. chap. ii.), which were first employed by Burckhardt in the case of the celebrated Lexell comet of 1770. The following are the elements deduced for perihelion passage in 1868, or the elements defining the orbit of the comet previous to its close approach to Jupiter; we annex Prof. Krueger's orbit for the present appearance for comparison :—

	Lehmann-Filhés, 1868	Krueger, 1884
Perihelion passage ...	Sept. 24·6 M.T. Berlin	Nov. 17·7922
Perihelion	352° 36′ 48″	19° 3′ 17″
Ascending node	207 33 50	206 22 17
Inclination	27 36 49	25 15 10
Angle of excentricity ...	16 11 5	34 3 12
Log. semi-axis major ...	0·663970	0·552936
Mean daily motion ...	358″·14	525″·536

The longitudes in both orbits are reckoned from the mean equinox 1884·0.

Prof. Krueger writes modestly as to the degree of accuracy of his elements, which have been adopted by Herr Lehmann-Filhés, nevertheless they were founded upon a fairly-wide interval of observation as noted above. From the nature of the problem, however, the orbit for 1868 must be regarded as roughly indicating the kind of track which the comet was then following. And it is to be remarked that the perihelion distance corresponding to the assigned values of excentricity and semi-axis major is 3·327, which would account for such a comet not having been observed while moving in the orbit of 1868. Thus, as in several previous cases, the comet appears to have been brought within range of visibility from the earth by the powerful attraction of the planet Jupiter.

THE WASHBURN OBSERVATORY, WISCONSIN.—Vol. ii. of *Publications* of this Observatory has been issued. Its main feature consists in a reduction of the star-gauges of Sir William Herschel, published and unpublished, or 683 gauges published and 405 unpublished, Prof. Holden having been indebted for the latter to Lieut.-Col. Herschel, R.E., who forwarded to him a complete copy of a manuscript, by Miss Caroline Herschel, in which they are given, and who was at the further trouble of extracting from the Herschel papers in the library of the Royal Astronomical Society the dates of the various sweeps. Also of 500 counts of stars from the published charts of Prof. C. H. F. Peters, 983 counts from his unpublished charts and those of Watson and Chacornac, and 781 from those of Palisa. Prof. Holden states that he is now discussing these various gauges by a graphical process, and that they promise to lead to very interesting results, especially when they are supplemented by other star-gauges covering the same ground and made by a larger instrument. The volume further contains a list of 111 new double-stars and two new nebulæ, with observations of red or coloured stars between December 1881 and the end of 1883, in continuation of a list given in the first volume.

GEOGRAPHICAL NOTES

REPORTS have been received from M. Alfred Marche, who is travelling through the Philippine Archipelago on a scientific mission for the French Ministry of Public Instruction. During June and July last he explored the archipelago of Calamienes, situated to the south-west of Mindoro and to the north of Paluan (Paragua) Island. This archipelago is composed of three large islands, Busuanga, Calamienes or Culion, and Linacapan, and about thirty smaller ones. M. Marche first visited Culion, the inhabitants of which are Tagbannas, similar to those whom he observed in a previous journey to Paluan. These form the principal as well as the most ancient people of the peninsula, and it is probable that formerly they occupied a much larger area than they do now. A small number of them, more or less Christianised, have submitted and built a village, to which, however, they come as rarely as possible. The others are independent, and are fetish-worshippers. In Culion there is but a single Spaniard, the priest. After Culion, M. Marche visited the island of Busuanga, where there were formerly Chinese colonies engaged in collecting birds' nests, and in trepang and pearl-fishing, both industries which no longer exist. In spite of continual rains the traveller was able to make a large collection of plants and of woods of all kinds. In Busuanga he came

across the inhabitants of Agutayo, one of the Cuyos Islands. They left their home, where they could hardly get enough to bring them to Busuanga, to fish for trepang and for small prawns, which they dried in the sun, and then sold to Chinese and Indians. M. Marche was able to take measurements of a certain number of these Agutaino. He gives long and interesting ethnographical details of the Tagbannas of this island, on their marriage ceremonies, funeral rites, &c. M. Marche then went in succession to the islands of Penon, Coron, Magao-Puyao, and Dibatac. In the last he observed that the hills, which are almost disafforested by the natives, and which are about two hundred metres in height, surround fertile plains in the form of a horse-shoe, more or less closed, and in the centre a depression is observable. The whole has the appearance of a funnel, and it is suggested that this is an extinct volcanic region. In the same island of Dibatac, crocodiles and boa-constrictors are very numerous, and M. Marche was able to capture one of the latter, which had swallowed a calf several months old.

ON the 2nd inst. Mr. H. M. Stanley inaugurated the newly-formed Scottish Geographical Association in the Music Hall, Edinburgh. Lord Balfour of Burleigh presided. On the 4th Mr. Stanley formally opened the rooms of the Society, and on Saturday last he opened the Dundee branch of the Scottish Geographical Society in the Kinnaird Hall.

M. ROMANET DE CAILLAUD has communicated to the Geographical Society of Paris two papers on Tonquin. One refers to routes from the delta of the Red River into Yunnan, the other on the history of the Thai or Laos race in Tonquin and Southern Kwangsi. In the former he describes in detail five routes, two by river and three by land, into South-Western China. The only one of these of importance is that by the Songkoi, or Red River, and M. de Caillaud makes light of its difficulties, and insists that Paris is practically nearer to the Yunnan frontier than either Canton or Pekin. Paris is at the most, he says, fifty days' journey, while Canton is sixty, and Hankow, on the Yang-tse, eighty days. He also advocates this route for an invasion of China, and says that Lao-kai, on the upper Songkoi, is really for France the vulnerable point of that Empire. As has been already pointed out, discussion of the Songkoi route above Hong-hoa must for the most part be based on speculation, as only one European has travelled down or up the river from or to Manhao, and his journey was undertaken in circumstances which hardly admitted of accurate observation. A German geographer has recently expressed the opinion that one of the chief difficulties to be encountered in this route will be ethnological, and M. de Caillaud, in his second paper, traces briefly the fortunes of the principal race of the region—the Laos or Thai. This people has apparently had its day. At one time it dominated the whole Indo-Chinese peninsula, but now it is split up among a number of independent or semi-independent princelets, whose main business is war and piracy. Their various attempts to recover a portion of their old power have been repressed by the Annamites, assisted, when necessary, by the Chinese.

LIEUT. BOVE, of the Italian Navy, has written to Dr. Hyades of Paris a letter respecting his second expedition to Terra del Fuego. The first, he says, was to some extent scientific. He was ordered by the Argentine Government to study the south of Patagonia and Terra del Fuego from an economical point of view, and scientific observations were merely adjuncts. Nevertheless a scientific commission to investigate the geology, botany, zoology, and hydrography of these regions was sent with him. Lieut. Bove's official report is about to appear in Spanish in Buenos Ayres, and will be accompanied by those of the scientific men engaged. The *Bolletino* of the Italian Geographical Society will contain a paper on his journey in the interior of Terra del Fuego among the Ona. He started from Ouchonaya with an escort of twenty-four Fuegians of the mission, who proved very useful to him. After crossing the mountains behind this place, he descended into the valley which runs down to Admiralty Sound. He describes the interior of the island as magnificent, and much richer than Patagonia. The Ona were met with but twice, and their total number is estimated at from 300 to 400. The total number of Fuegians in the whole archipelago is stated, according to a careful census made by an English missionary, the Rev. Thomas Bridges, to be only 949 men, women, and children.

M. MICHEL VENUKOFF has addressed a note to the Geographical Society of Paris, referring to a new map of the island of Saghalin, prepared by M. Nikitine, the topographer. It differs from all the other maps of the island in some respects. It shows it to be considerably larger than had been previously believed. M. Reclus gives the area as 63,600 square kilometres. M. Strelbitsky 67,018, and Venukoff 73,529. Although the writer claims that his bases for calculation were necessarily more detailed and exact than those of his predecessors, he nevertheless considers his figures as approximate rather than final.

SCIENTIFIC ASPECTS AND ISSUES OF THE INTERNATIONAL HEALTH EXHIBITION[1]

[THE first Wednesday lecture at the Society of Arts was devoted to an address on this subject—in accordance with precedents—the Duke of Buckingham, Chairman of the Exhibition Council, taking the chair. The following are the parts of the address relating to the scientific departments of the Exhibition, and the proposal which the lecturer is understood to have laid before the Council for some time for the disposal of the surplus to such objects.]

There was only one exhibit in the food department to which I would specially call attention, it was that from the collections of the Science and Art Department and the Parkes Museum, illustrating the constituents of food and food values, and the connected exhibit by the Society of Public Analysts, of materials used as adulterants of articles of food; of adulterated articles of food commonly sold in this country; of adulterations which have been suppressed; of adulterations practised abroad, and mixtures generally protected by labelling. This latter was added in consequence of a suggestion made by the late Mr. Wigner, President of the Society of Analysts, at a late date in the progress of the Exhibition. I am afraid that it did not attract all the attention that it deserved. I trust, however, we shall be able to reserve it for continual public reference. Mr. Wigner, in communicating with me, pointed out that, although the Exhibition was most successfully arranged so as to display in a prominent manner all the articles connected with food, yet the public were only shown what is done by the most careful and respectable firms, whose names are a sufficient guarantee that only materials of the highest quality are used in the preparation of the goods which they show.

All who are connected with food produce know how, from time to time, the desire on the part of the consumer for cheap goods is the cause of the introduction of articles called "substitutes," which are offered to the manufacturer at one-third the price of the genuine material, and which frequently consist of some cheap and simple preparation, the very opposite in its chemical character to the article for which it is said to be an efficient substitute: several cases of this kind had recently been brought to Mr. Wigner's notice. For instance, he referred to an article to be used as a substitute for tartaric acid, the composition of which has been found to be acid sulphate of alumina in solution—a substance which, if introduced into the manufacture of bread or biscuits, is as objectionable as alum, and quite as much an adulterant. Bisulphate of potash is also sold under a name similar to tartaric acid, and is equally as worthless as sulphate of alumina. These are only two instances out of many, and serve as an additional argument to show the keen competition in trade, which causes the manufacturer to produce, and unscrupulous firms to sell, such articles under "Royal Letters Patent," or some other heading of this sort, to attract the notice of the consumer.

The public analyst, Mr. Wigner added, although, of course, he should be cognisant of these facts, has quite enough work for the remuneration paid to him, and in addition to this, there is the fact that the Sale of Foods and Drugs Act is so limited in its aim and scope as to practically prevent the analyst from testing anything but the common articles of food, such as bread and milk, unless they are sold under some recognised name. Let him once travel outside these lines, and a whole host of objections are raised. What is really wanted is more stringent legislation, similar in character to that at present in operation in the United States and Paris.

In the French Section were shown the monthly reports of the Municipal Laboratory, showing the complete and thorough manner in which the food-supply of that city is protected. Why cannot something of the same sort be done in London? What is wanted is a measure defining what is and what is not adulteration, and prohibiting the use of articles which are fre-

[1] Extracts from an Address delivered at the Society of Arts on Wednesday, November 26, by Mr. Ernest Hart, Member of the Executive Council.

quently employed at the present time, and the sale of which, while benefiting one class, seriously injures another, by substituting an inferior article for one of better quality.

Considerable good, it may be hoped, was done by the Health Exhibition by the exhibition of these so-called substitutes. The prominent display of this instructural series in a National Exhibition has, we trust, done something towards putting a stop to a trade which, while it enriches the unscrupulous trader, places the honest manufacturer in an awkward position.

How far it has fulfilled this intention is of course not yet apparent, but I shall certainly feel it a part of my duty in another capacity, as Chairman of the Parliamentary Bills Committee of the British Medical Association, to endeavour to keep the attention of our legislators to this important subject. It may be hoped that, when the political horizon is sufficiently cleared to enable Parliament to devote some time to interests of almost as important, if less strictly party, a character as those which are now occupying their attention, that it may be possible to secure for the people of England, or at least for the people of this metropolis as an example to other great towns, some of those better securities against the adulteration of food which this country was the first to set the example of creating by legislative action, but as to which it has at the present moment fallen behind some of those countries which followed us, such as France, Belgium, and America. It is within my knowledge, and in fact within my personal experience, that in all those countries our English legislation was originally the model which they set before them. In fact, in the case of several of these countries, I have had the opportunity of receiving the gentlemen who had been sent over by their various Governments, and of furnishing them in several instances with the opportunities of study and materials of which the respective Governments have availed themselves to create model laws respecting adulteration; I would refer here especially to the German code.

It is hardly to our credit that we have allowed ourselves to be distanced in a race in which we had so considerable a start, and in which the sole goal is the public benefit, and the maintenance of the public health. These are questions largely affecting the health of the whole nation, and especially affecting the welfare of the poor, who suffer most by the substitution of worthless, inferior, or adulterated articles in the fabrication of apparently cheap, but often very dear because worthless, articles of food.

Heating, Ventilation, and Smoke Abatement.—The testing of exhibits in Classes 24 and 25—Heating and Ventilating—were carried out on a considerable scale. Some 120 kitcheners—some burning solid fuel, and some gas—were tested. A large house was rented for conducting these trials, under conditions approximating to those which would be found in the actual use of the apparatus by the public, and a large number of tests of cooking joints, &c., in the kitcheners, &c., were made. The importance and necessity of exact testing, initiated by the Smoke Abatement Committee of 1881, and since carried on in a systematic manner by the National Smoke Abatement Institution, were fully recognised by the Executive Council of the Health Exhibition. The series of testings were conducted by the acting engineer to the Smoke Abatement Institution, Mr. D. K. Clark, and the jury of the Exhibition dealing with these exhibits included Prof. W. Chandler Roberts, Mr. Robert Harris, President of the Gas Institute, and other members of the Smoke Abatement Institution whose special knowledge peculiarly fitted them for the work.

The practical advantages of such testings have been manifested in the great interest taken by exhibitors in the work, their general desire to submit their manufactures for testing, the evidently accelerated course of improvement in design since the Smoke Abatement Committee first introduced the system of tests, and the advanced knowledge derived from the results of those tests.

At the Health Exhibition these beneficial influences were clearly traceable in the adoption of good ideas embodied in apparatus shown at the Smoke Abatement Exhibition in 1881, and brought into notice by the testing treatments adopted there, as well as in the rejection of plausible but impracticable methods of heating and ventilation which found place in the earlier exhibition. The detailed report of the tests of the apparatus shown at the Health Exhibition I trust will be published, for it will form a valuable addition to a continuous and advancing series of tests. The importance of this branch of my subject can hardly be exaggerated. We can follow, in the light of the knowledge derived from the result of the later tests, a regular and most encouraging course of improvements. For example, some of the exhibits shown at the Crystal Palace Exhibition last year, in the class of gas-cooking and heating-stoves, were proved to have a greater efficiency, by about 20 per cent., than those shown at the Smoke Abatement Exhibition in 1881; while at the Health Exhibition the efficiency proved by the tests was fully 25 per cent. greater than at the original Smoke Abatement Exhibition. Besides this increased efficiency, or improvement, to be measured by lower consumption of gas for equal work done, there has been an improvement hardly less important in numerous points of detail, affecting both the durability of the apparatus, and the facility with which it can be cleaned. These latter improvements, added to the lessened price of gas, and the reduced consumption of it in the newer forms of stove, cannot fail to tend towards the increased use of these cleanly conveniences and smokeless heating appliances for domestic purposes.

The testings at the Health Exhibition brought out the merits of a number of kitcheners and stoves very well adapted for using coke and "slack," or small coal, as well as improved patterns for using the ordinary lump coal, with lessened production of smoke. In regard to the advance made in smoke prevention from domestic fires, I may mention, on the authority of the testing engineer, that the highest average smoke shade proved by the tests of 1882 was 4·18 from kitcheners; and in the test at the Health Exhibition, the highest average was only 2·4; and from open grates the average density of the smoke was 3·0 in 1882, and at the Health Exhibition it was only 1·75. The importance of facilitating, by means of improved apparatus, the use of coke and the cheaper fuels now generally wasted is obvious, and I think I may fairly claim that this section of the Exhibition achieved a highly useful and successful result. In the bakeries department no less than five distinct systems of heating bakers' ovens, practically without the production of any smoke whatever, were shown—and not only shown, but were proved by an extended course of actual working—to be more or less well suited to the requirements of the trade. Varieties of machines for making dough by cleanly and expeditious methods were successfully worked throughout the period of the Exhibition, and it is but reasonable to assume that the exhibition of these machines, shown daily in satisfactory working, must have a great future influence in putting a stop to the laborious and filthy process of making dough by manual labour.

The Library.—The library sub-committee report with great satisfaction that the library has proved an unqualified success, and that it has attracted not only a large number of readers, but a considerable proportion of serious students.

Although no purchases of books have been made, upwards of 5000 works are now included in the collection, of which over 3000 relate to health subjects. The great majority are free gifts, a small proportion are on loan. They express a strong hope that a collection of books so useful as the nucleus for the formation of a special library will not be dispersed, but that the Executive Council will devise means to maintain the library on a permanent footing, as part of a memorial of this useful and successful national undertaking.

The library was altogether a novel feature in any exhibition of the kind, and its value was attested by the considerable number of serious students who availed themselves of its extensive resources, many of the n being University students, who used this unwonted opportunity in preparing for examinations. The advantages to be derived from retaining the library as a permanent institution would be great. I put before you a copy of the catalogue, made entirely by Mr. Carl Thimm. This catalogue is in itself a publication of no small interest, being the most complete catalogue of sanitary literature with which I am acquainted (although of course it cannot be said to be complete in even an approximate sense, but must only be regarded as a very valuable nucleus for a larger library), in which the hygienic literature of foreign nations, and especially their official hygienic literature, is very largely and well represented.

The Sanitary and Insanitary Houses.—Of the sanitary and insanitary houses a special handbook has been published, which will be preserved among the literature of the Exhibition, and which constitutes a small epitome of the ordinary defects of existing houses, and the simple means by which such defects may in future be avoided. I shall not enter into any description of these houses, for they are already well known to most of you, and may, I yet hope, be further studied on some future occasion. But I wish to draw your attention to the very important conferences on the sanitary arrangement of houses which were held

by the Institute of British Architects in connection with this part of the Exhibition, and especially to that held in the last days of the Exhibition by the Guild of Plumbers. This I call your attention to because there is good reason to hope that out of this will spring an organisation, and I trust a legislation, which will, perhaps, do more towards the preservation of health and the saving of life than most of the much more pretentious forms of legislation which we must contemplate in the near future. The Exhibition will, in virtue of the organisation likely to follow from this conference, become the means of drawing together all those scattered forces which have for some time tended in the direction of a great improved regulation of the sanitary condition of our houses: a force, however, which, up to that moment, there seemed but little hope of being able so early and so practically to organise. I feel a peculiar interest in this subject, for I have now for several years, as Chairman of the National Health Society, and in connection with the Sanitary Section of the British Medical Association, occupied myself with collecting the facts and figures which demonstrate the urgent necessity of improved legislation for the safeguarding of the sanitary construction of our houses, and the improved education and registration of those builders and plumbers to whom we intrust that construction. I read on this occasion at the opening of the Congress a paper which I had prepared three years before, and which, in fact, I have in various forms presented to several professional and lay bodies, with the view of forming and gauging public opinion on the subject. I shall venture to put before you here now only the conclusions which I laid before this Conference, which practically and in principle received their approval, and which will thus, I hope, have an earlier chance of finding their way into the statute-book. They have the object of strengthening our statute law as to drainage and plumbing. I desire to enlist the aid of the Society of Arts in bringing into legal operation, as one result of the International Exhibition, the proposals which will be found in the Report of the Conference, of substituting sanitary for insanitary houses.

First as regards drainage itself:—

(1) Rural authorities should have the same powers as are now possessed by urban authorities. In the suburbs of towns, just outside the municipal boundaries, thousands of houses are springing up without any sanitary supervision whatever. The rural authority is, perhaps, unaware of the evil, or is, at any rate, careless about it until the houses are erected; and their opportunity of making by-laws which can control such houses is then lost.

(2) It would be well that the requirements of the Model By-Laws as to New Buildings issued by the Local Government Board should be incorporated in a Building Act which should be forthwith passed, and be of general application throughout the country.

(3) The plumbing and drainage of all buildings, public and private, should be executed in accordance with plans and specifications previously approved in writing by the local authority.

(4) No drainage-work should be allowed to be covered or concealed in any way, until it had been examined and passed by the surveyor.

(4A) The efficiency of all drains should be tested by the peppermint or some other test before they are passed; and it should be a rule that, wherever possible, drain-pipes should be kept from view only by boarding which can be readily removed.

(5) No new house should be allowed to be inhabited until it had been passed and certified by the surveyor, and a plan of the system of drainage should be appended in every case to the lease or other document for the letting of the house.

As regards the plumbers, I suggest that—

(6) The names and addresses of all plumbers should be registered by the local authority, and no plumber should be able to carry on his trade until he had been so registered, and had received a license from the local authority.

(7) Before the license is granted to him the plumber should attend personally at the office of the local authority, for examination as to his qualification as a plumber.

(8) Such licenses should be renewed from year to year, and their continuance should depend upon the good behaviour of, and the return of the work done by, the licensee.

(9) The names of all licensed plumbers should be publicly advertised once a year by the local authority.

The result of this Conference will live. Before long, I think we may promise ourselves, we shall see, as one result of this Exhibition, an active movement set on foot by which we shall henceforth be enabled to train skilled and educated workmen, and to ascertain by suitable tests their efficiency, and by which we shall be enabled to protect our artisans and ourselves from occupying houses which have been built with a total disregard or flagrant defiance of the first principles of sanitary construction, and of the conditions which we all know to be primarily essential to healthy occupation.

The Health Laboratories.—I pass to the laboratories. It did not at first, I think, appear evident to some of the members of our Council how close was the connection between the work to be carried on in these laboratories and the public health. Happily, however, that feeling soon gave way to one of acquiescence in the proposition which I made for the establishment of these laboratories, and, since, a closer examination of the subject has, I think, convinced every one that it is to establishments of research and of study, such as those over which Mr. Watson Cheyne and Prof. Corfield presided, that we must look for the most solid foundations for future progress in solving the highest problems connected with the preservation of health; and that no part of the Exhibition fulfilled a higher purpose, and to none can we look with more assured hope in the future, than to these departments of the Exhibition. A description of the laboratories appears in the official catalogue, and I shall not occupy your time with any description of them.

At the Hygienic Laboratory, in its chemical and physical departments, the public were not merely given the opportunity of seeing hygienic analyses of various kinds going on, and of having them explained to them either by Prof. Corfield or his assistants, individually or in the form of popular demonstrations—of which a considerable number were given, chiefly by the senior assistant, Mr. C. E. Cassall, during the time the Exhibition was open—but they also had the opportunity of seeing the ordinary working of such a laboratory, from the fact that Prof. Corfield was able to utilise this laboratory for his students. A class of about forty teachers, selected by the Science and Art Department from schools in all parts of the country, attended a course of lectures given by him at the Normal School of Science, and at the same time worked in batches in the hygienic laboratory at the Health Exhibition, and thus the public were enabled to form an idea of what such a laboratory is in full working order; and, indeed, during the whole time that the Exhibition was open after the above-mentioned class had dispersed, there were pupils who worked in the laboratory.

In a complete hygienic laboratory there should be a separate part set aside for physical experiments relating to hygienic appliances; but in this laboratory there was barely space for the chemical work to be carried on, and even the microscopical work could only be prosecuted to a limited extent, insomuch that the class of teachers went through their course of microscopy relating to hygiene in the physical laboratory at the Normal School, and the absence of physical appliances was replaced, as far as it could be, by demonstrations given by Prof. Corfield at the sanitary and insanitary houses.

As regards the Biological Laboratory, it is sufficient for my purpose to-night to remind you that in it Mr. Cheyne, the worthy pupil of Sir Joseph Lister, who acted as chairman of the Laboratory Sub-Committee, showed by practical working, and by collections such as had never before been seen in this country with the same completeness, the refined methods of research and of teaching by which we are enabled to study the life-history and the habits, the development and the means of arresting the development, of those minute organisms which modern science has shown to be prime factors in the causation of a great proportion of the most fatal diseases which afflict our flocks and herds, which decimate mankind, and which attack those plants and animals which constitute the staple of our food-supplies. Mr. Cheyne's demonstrations were eagerly followed by health students from all parts of the kingdom. A certain number of tables were set apart for study and research, and these were fully occupied from the first to the last days that the Exhibition was open. In Dr. Corfield's laboratory was collected the apparatus for that kind of instruction in the chemical and physical examination of soil, air, water, food, clothing, and materials of house construction, which are essential elements in the education of that great army of medical officers of health who are appointed now under existing Acts of Parliament to watch over the health interests of the community. It is very well known, however, that a large majority of those gentlemen have not this necessary instruction, and that at the present moment there does not exist in this country any adequate means for giving such instruction. There are in England 1102 medical

officers of health, and 996 inspectors of nuisances, all of whom are expected to get their information and to acquire the technical knowledge of which they stand daily in need as best they can; and it is well known that a large proportion of them are very imperfectly equipped with the necessary knowledge, and indeed can hardly be said to possess even the rudiments of systematic technical education in subjects in which they are presumed to be experts, and which they are called upon to decide in matters largely affecting the pockets of the community and intimately concerning its health. In order to illustrate the importance of the establishment in this country on a permanent footing of such laboratories as those which were shown in temporary working at the Exhibition, I shall ask leave now to refer you to an exhibit which was made in the French Court, illustrating the work done by M. Pasteur in a similar laboratory to that of which I am now advocating the permanent establishment, as the best possible sequel of this great Exhibition.

M. Pasteur is the scientific director of the École Normale supérieure in Paris, a school especially designed to supply professors in literature and science to the *lycées* or higher schools of France. He is not, however, called upon to undertake teaching, but is expected to devote all his time to his researches. In a word, in consideration of the considerable national services which he has rendered, an exceptional position has been accorded to him. He receives a professorial salary of 400*l*. a year. M. Pasteur is also the head of l'École des Hautes Études, of which Mr. Chamberlain is the sub-director. In this laboratory he receives some pupils. He possesses further a laboratory at the École Normale, where M. Roux is his coadjutor, and where are admitted some students who are generally persons already known for their studies. He has entire freedom of the choice of students of the laboratory of l'École des Hautes Études, as well as those of persons who work in his private laboratory at the École Normale. About 800*l*. a year are allowed for this laboratory by the Minister of Public Instruction, and for the last few years, 30,000 francs from the Minister of Commerce and Agriculture. These grants are renewed yearly.

The principal researches of M. Pasteur have related to—

(1) *Wine*, in which he demonstrated that, in order to avoid the transformation of alcohol into acid, it is necessary to destroy the germs remaining in wines which are poor in alcohol, by heating them up to 55°-60° Centigrade. He has also studied the action of oxygen and light on wine, and has demonstrated that it is to this action, *i.e.* to the oxidation of the materials of wine, that we are to attribute the development of the bouquet of wine, *i.e.* the flavour which it acquires with age. In order that this may yield a product appreciated by amateurs, it is necessary that it should proceed slowly. He has further demonstrated that the ferment of wine exists on the surface of the grape when it has ripened. He has demonstrated the useful and precise indications which the areometer furnishes, in order to appreciate during fermentation the state of the *mout* of the grape.

(2) *Beer*.—After having demonstrated that brewers employ, generally, a ferment containing, among others, injnrious germs, M. Pasteur indicates the following means for obtaining a pure ferment. A small quantity of pure yeast is prepared according to the exact rules of the laboratory. This is introduced into a large copper pan, three-quarters filled with the wort of beer, which has been first carried to the boiling-point, and then cooled before the introduction of the yeast. The vessel only communicates with the external air by a long tube of copper, many times bent, in such a way as to permit the gases to escape without external germs being able to enter. When the wort has been developed, it is drawn off by a tap placed in the lower part of the apparatus, and which is previously purified with the flame of a spirit lamp. The wort of the beer is put to ferment in a large white-metal vat, resting on a plank, and closed by a movable cover, this movable lid dropping into a groove which is kept full of water. As the wort arrives in a boiling state in this vessel, it destroys any germs which may exist there. When it is cooled, and the cooling may be rapidly aided by the use of external cooling water, the yeast is introduced through an opening in the lid. The aëration of the fluid is obtained by two tubes curved downwards, by one of which carbonic acid escapes, and by the other the air enters after being previously filtered through a layer of cotton wool rolled round a cylindrical cage on metal wires which cap the extremity by which the air enters. This apparatus, like the foregoing one, reproduces exactly the conditions which are found to be necessary in the laboratory to prevent the introduction of external germs. The aëration by these two tubes is sufficient, for the carbonic oxide being heavier than air, they are placed in such a way as to form a siphon; moreover, during the fermentation, the wort is certainly kept in movement by the ebullition of the gas which escapes, so that the aëration, although less active than in some of the technical apparatus previously in use by brewers, is more than sufficient. By employing this procedure, secondary fermentations are no longer to be feared, and the spoiling of beer by secondary fermentation is almost entirely put an end to.

(3) A third and profoundly interesting series of researches, which have had a great influence on agriculture, carried on by M. Pasteur, are those relating to *charbon*—the malignant pustule or black quarter of cattle and sheep. M. Pasteur has demonstrated that animals of the ovine and bovine species may be prevented from contracting the disease of *charbon* by inoculating them with attenuated germs, obtained by artificial cultivation of the specific minute organism which is ascertained to exist in the case of *charbon*, and to be the efficient cause of the disease. This attenuated preventive material for inoculation is obtained by the aid of what are known as cultivations of the germs made in special liquids. After the first inoculation with the highly attenuated virus, Pasteur has shown that the second inoculation may be made with a product of medium virulence, and that the animals thus twice vaccinated were unsusceptible of contracting the disease. Pasteur has further demonstrated that the bacterium of *charbon* is capable of retaining its vitality for several years in the earth, and that, when brought to the surface by earth-worms, it is capable of infecting the animals which eat the grass polluted by its contact, especially if the grasses or plants so eaten be hard, and such as to cause abrasions in the mouth and digestive tube.

(4) *Silkworm Disease*.—M. Pasteur, after having assured himself that normally, and in good health, silkworms never contain, at any moment of their life, the bacteria or corpuscles seen for the first time by Guérin Menneville, demonstrated that the eggs of the worms, even when only slightly attacked, contained a great number of these corpuscles of bacteria, which developed in considerable quantities when the animal underwent its metamorphoses, and finally destroyed it. Since its droppings polluted the leaves of the mulberry on which the silkworm feeds, and as healthy animals thus devoured them, and contracted the same disease, a single infected silkworm was capable of destroying a whole school of worms, and preventing the subsequent cultures from being developed.

M. Pasteur then laid down the rule that, in order to avoid the silkworm disease, it was necessary to choose with extreme care the animals which were to be employed for breeding. With this view he devised the following procedure:—When the female has laid its eggs it is at once destroyed. If a single corpuscle is found in its tissues, when crushed in water, the eggs are immediately burned. In the same way the several eggs of each hatching are carefully examined. If no corpuscles are discovered, the whole brood is preserved for culture; if any are found, the whole are immediately destroyed. Since that time the silkworm breeders have followed the rules of M. Pasteur. The implements for the purpose of recognising the diseased worms consist of a microscope, two objectives, one with low power, and one with high power, magnifying about 400 times, and a small porcelain mortar for crushing the tissues of the worm or its eggs, some glass slides, and a flask of distilled water. By this application of scientific research to the silkworm industry the silkworm disease has been almost wholly put an end to. Nearly all the silkworm growers, whether masters or servants, have learnt, by the aid of a very cheap little handbook, prepared by M. Pasteur, to recognise diseased worms or eggs from healthy eggs or worms, and thus a great industry, which was threatened with extinction, has been saved from the fate which threatened it.

(5) *Fowl Cholera*.—After having demonstrated that this affection is caused by a micrococcus, M. Pasteur showed that if this micrococcus is cultivated in the manner which he indicates, and the micro-organism thus obtained inoculated in a fowl, the fowls so vaccinated become proof against fowl cholera, even when they are placed in the midst of other infected fowls. These researches have a special and suggestive scientific interest, for he has shown that if you filter through plaster the liquid taken from one of the external foci of the disease in a fowl affected with fowl cholera, the filtered liquid thus inoculated will not give a healthy fowl the specific disease, but render it somnolent

and inert for some hours, so that it may be concluded that the micro-organism secretes a material to which must be attributed the lesions which are observed in fowls suffering from fowl cholera.

Some idea may be obtained of the commercial value of the work done by M. Pasteur in his laboratories from the following facts and figures, which I have on good authority:—In three departments of the centre of France, after the silkworm disease had attacked the factories, the product yielded a value of less than 1,500,000 francs. Since the regulations laid down by Pasteur have been applied, the average value per annum, calculated on five years, in those departments has risen to more than 22,000,000 francs.

As to wine, there was a known loss of wine to the extent of 1,700,000 francs in four departments. Since heating on Pasteur's method has been applied, there has been saved of this loss at least 1,500,000 francs; the difference of 200,000 francs being alleged to be due to the carelessness or ignorance of small proprietors, who are unwilling to heat their wine. As there are in France about forty-five departments that make wine, the saving may thus approximately be estimated. I should add that there are twelve departments that make silk.

In respect to anthrax, the following was the official statement indicating the ravages made by this disease in France and foreign countries, and the reduction of mortality effected by these inoculations:—

1881	Sheep		Oxen		Horses
France	62,050	...	5977	...	142
Foreign countries...	12,500	...	1254	...	100
Total	74,550	...	7231	...	242
1882					
France	270,040	...	35,654	...	1825
Foreign countries...	36,830	...	6,169	...	200
Total	306,870	...	41,823	...	2025
1883					
France	268,205	...	26,453	...	371
Other countries ...	84,825	...	5,777	.	975
Total	353,330	...	32,230	...	1346

The average mortality reduced by these inoculations in the proportion of 10 to 1 for sheep, and 15 to 1 for oxen, cows, and horses.[1]

Meteorological Laboratory.—The corresponding exhibit was that of the meteorological laboratory by M. Miquel, corresponding to which I hope to see a permanent meteorological station established as a sequel to the Exhibition. The work of M. Miquel has been summarised in the following words by Dr. Vivian Poore:—The observatory for Montsouris was established, in 1871, by the influence of M. Dumas, who was then President of the Municipal Council of the city of Paris. In 1873, M. Marié Davy was appointed director of the observatory by M. Thiers. The work of the observatory is as follows:—

(1) Meteorology proper, and its application to agriculture and hygiene. This department is under the control of M. Léon Descroix.

(2) Chemical analysis of the air and rain, under the control of M. Albert Lévy.

(3) The microscopic study of the organic matters held in suspension in the air and rain. This is under the control of M. P. Miquel.

In 1876, the municipality decided to have the above meteorological observations, in their relation to hygiene, made in different parts of the city. The chemical analyses and microscopical examinations are made—

(1) On drinking waters.

(2) On the waters infiltrating the soil.

(3) On the emanations from the soil and sewers.

(4) On the air of different localities estimations are made. A. (air), ozone, carbonic acid, ammonia, organic nitrogen; and similar analyses are made of the soil-water, &c. Every year the *Annuaire de Montsouris* is published, a work full of information, and which is now in its thirteenth volume.

The laboratory of Mr. Cheyne at the International Health Exhibition was largely fitted up by the aid of Dr. Koch, and of Dr. Koch's laboratory at Berlin. Mr. Cheyne has furnished me with the following outline:—

Dr. Koch's laboratory is subsidised by the Government. It consists of director, library, biological department under Dr. Koch and several assistants, and a chemical department. All expenses of investigation are paid. Koch's salary is only 300*l.* Other salaries I do not know. When appointed, Koch first set to work to improve methods of cultivating and studying bacteria, and to devise new methods, and the result has been a precision and simplicity in this sort of work quite beyond all expectation. His further researches have been devoted to the study of the cause of disease in man and how to prevent it. Either by himself, or under his direction, the causes and means of prevention of tuberculosis, consumption, erysipelas, osteomyelitis, and glanders have been absolutely demonstrated, while a large amount of work has been done in respect to the causation and prevention of typhoid fever, cholera, diphtheria, and other affections. His researches on disinfectants and the best mode of disinfection are classical, and are still being carried on. This work is being rapidly extended to other diseases, while important researches are going on relating to water, air, and soil.

The Anthropometric Laboratory at the Health Exhibition was designed by Mr. Galton, to show the feasibility of performing, at a small cost, an extended series of measurements of the human faculties, and of testing the demand that there might at present be for having such measurements made. The ulterior object he had in view was to familiarise the public with the facility and need of periodically recording facts which test the progress of individual growth and development, whether it is proceeding normally or otherwise; and if it should be abnormal, to call attention to the existence of hurtful influences, and to demand inquiry into their nature, and whether they may not be removable. The experience of the laboratory showed emphatically, first, that about seventeen different measurements of each person, including height, weight, strength, breathing capacity, eyesight, judgment of eye, hearing powers, &c., could be accurately performed at a cost of less than 3*d.*, by means of a well-organised method of work; secondly, it showed that the public greatly valued the opportunity of having themselves measured and appraised in so minute a manner, inasmuch as the door of the laboratory was besieged all day long by a crowd of applicants for admission, far more numerous than could be accommodated in its small area, 36 feet long by 6 feet wide. As it was, measurements were made of between nine and ten thousand persons, yielding data that are now being discussed, and which have considerable statistical value. The methods and appliances used and suggested by the experience of this laboratory have been very recently described by Mr. Galton at the Anthropological Institute. It is therefore not necessary here to go into details. It may be taken as established that there need not be the slightest difficulty in periodically measuring with much completeness and keeping a register of the development of every boy and girl in large schools, at the cost of a very few pence per head per annum, on the supposition that the process was methodically conducted by a paid expert, with the willing and gratuitous assistance of the masters and attendants. The power of a system of periodical measurements and tabulated returns upon the well- or ill-being of the growing portion of our race is of unquestionable value, and it would seem that common-sense considerations must insure its being ultimately called into action. Now that there are signs of much awakening to the importance of such records, a central institution becomes especially desirable, where the best patterns of instruments should be kept, where instruction in their use might be obtained, where the methods of tabulation, and of quickly getting useful results out of the data, might be learnt, and where the fullest information of all kinds on anthropometry would be stored. It must not for a moment be supposed that anthropometry is a simple and thoroughly understood art. On the contrary, it continually grows, new methods being discovered from time to time of measuring faculties that had before escaped measurement. There can be little doubt that the progress of the useful art of knowing one's self all round, and of knowing others accurately, of reducing what has hitherto been too much a matter of estimate to quantitative measurement, would be very largely aided by the establishment of an anthropometric laboratory in a national hygienic institution.

Proposed Disposal of Surplus.—That which I look forward to, then, as the best possible sequel to this Ex-

[1] In the last thirty years there has been an increase of life-duration of from 39·9 to 41·9 years, an increase of 5 per cent. human duration of life. The annual economy of life, on the least favourable calculation, during the last five years, has been equal to a saving of 36,000 lives per annum. The money saving on the last five years has been calculated, on good basis, by Capt. Galton, to be in London alone nearly half a million of money per annum.

hibition, is the establishment of these laboratories, so vastly important to the prevention of disease and the maintenance of our population in health, and of the library on a permanent footing and under suitable direction. The whole subject is one on which I can only venture to express, thus far, my individual opinion, although I have the satisfaction of knowing that the views which I have thus put forward have met with considerable approval among many of my colleagues, to whom I have submitted them *in limine* for future consideration by the Executive Council, who may possibly approve of them, and in that case may feel it their duty to submit them to his Royal Highness the President, with whom will rest the ultimate decision as to the disposal of any parts of the surplus. The rumour that such a project was about to be submitted to the Council, has awakened the liveliest interest and satisfaction amongst the authorities of the leading sanitary associations in this country, and I am glad to know that the authorities of the Parkes Museum, of the Sanitary Institute, of the Social Science Association, of the Society of Medical Officers of Health, and of the National Health Society, have each, on their own individual motion, taken the opportunity of expressing, by resolutions and memorials, their strong sense of the great national value which they consider would attach to the accomplishment of this design. Should this proposition prove acceptable to the authorities, there is no doubt that the opinion of the great body of persons interested in the sanitary progress of this country, thus early expressed by the official representatives of every form of sanitary progress, would declare itself strongly in favour of an institution from which considerable results might be anticipated in the furtherance of health education, and of our knowledge of all that relates to the prevention of disease. It is further hoped that an Institute of Public Health, founded on this basis, might prove a home and centre with which these numerous voluntary organisations now working for the public health might connect themselves, by some well co-ordinated and accepted plan; that it might be a centre where their members would be able to meet; where libraries, class-rooms, and meeting-rooms might be made to serve a valuable purpose in bringing these various societies into closer relation. There is reason to hope that many of the great scientific associations which now foster the progress of science by grants to individual workers, would heartily welcome the establishment in this country of what it so greatly stands in need—a place of higher education and research in sanitary science, such, as I have already pointed out, as have been recently created in France and Germany. England has been first in sanitation; it is here that have been solved—so far as they have as yet been solved—many of the greatest problems of sanitary science; but we must acknowledge that, during the last decade, each of these countries has made progress in the higher departments of sanitary education and sanitary research, in which we can hardly be said to have held an equal place. This reproach we may now find the means of wiping away, and I earnestly trust that this may prove to be a sequel of the International Health Exhibition, than which no higher memorial could have been hoped for or expected.

The Lesson of the Exhibition as to Open-air Recreation and the Electric Lighting of Public Parks.—Let me conclude by reference to another aspect of the teaching of the Exhibition, less scientific, but yet of peculiar public importance. It was often said by the public scorner—a person from whose judgments and criticisms we have commonly much to learn—when walking through the crowded course of the Exhibition devoted to food and all that concerns the construction and decoration of the dwelling: "This is a Health Exhibition—where is the health?" and the popular answer was, "Outside in the gardens." That answer also I accept. I think you will agree with me that the practical demonstration which this Exhibition afforded of the eagerness of the English people to resort to healthful means of outdoor amusement was in itself a valuable result and an important experience. The gardens, illuminated by the electric light and enlivened by music, were undoubtedly a great attraction to the Exhibition, and I would be quite willing to agree with any one who might say that they were the greatest attraction. Allow me to add that I look upon this not merely as a means, but itself an end. It is no small thing to have acquired the conviction that our open spaces may be, and should be, much more largely devoted to the open-air recreation of the people than they are at the present moment. I say this now, without any intention of entering upon that large question, but with the specific desire to repeat (for it is only by repeating often that one can gain access to the minds of the majority who are all-powerful in such questions) that it appears to me to be no small disgrace to this great metropolis that, in the very centre of its crowded districts, within an arrow's flight of the houses probably of most of us who are here, there lie great open spaces, such as Hyde Park (but what I say refers also to Victoria Park), which at night are dreary desolate areas of darkness, which are unlighted, which are dangerous to cross, which are unused in the evenings for any wholesome or moral purpose, which are often scenes for the display of some of the worst vices incidental to the lowest dregs of the population of the great city. Why should we not learn from the success of the music and the lighting of the gardens of the Health Exhibition, that our great parks should all be lighted by the electric light at night, and that throughout the spring and summer months the military bands should play there, and should make those places, which are now not only useless but scandals to the metropolis, the sites of healthful and innocent recreation? I have inquired from a good source what would be the cost of lighting Hyde Park by the electric light; and I am not speaking without data when I say that I believe that Hyde Park could be adequately lighted with the electric light, so that it might add to the resources of health and enjoyment for the teeming population surrounding it, at an annual expenditure of about 5000*l*. I do not know what impression this will make upon you. I confess that to me such an expenditure seems trifling in consideration of the sum of human happiness and enjoyment, and, I may add, also of health, which such a devotion of municipal or public money would afford to the people of this city. Nor is it likely that, the example once set, it would end here. Our eastern population have a right to the enjoyment of their parks in the evenings that could be conceded to the west. This lesson also, then, the Exhibition seems to me to teach, and how greatly we might all rejoice if it should ultimately prove that the lighting by electric light of our public parks, and the introduction of music as a part to enliven and attract the people, and to add to the success of the innocent recreation, the health and the happiness of our working population should form also one of the possible sequels of this Exhibition.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—Prof. Roy was on Thursday last admitted to the degree of M.A. *honoris causâ*. The Public Orator in presenting him spoke as follows:—

Dignissime Domine, domine Procancellarie, et tota Academia,—Quis nescit Athenas illas Caledonicas, cum aliarum artium, tum praesertim studiorum medicorum praeclaram esse sedem. Academiae tam illustris alumnum, Pathologiae Professorem primum nobis nuperrime datum, hodie senatus totius nomine salutamus, ipsum senatorum nostrorum ordini libenter adiungimus. Neque vero una tantum doctrinae sedes Professorem nostrum sibi vindicat; scilicet Germaniae ipsius Academiae celeberrimae hunc virum inter alumnos suos numerant. Ne inter Cantabrigienses quidem prorsus hospes est, qui non modo Physiologiae praeceptoris nostri optimi experimentis aliquamdiu interfuerit, sed etiam ipse de Physiologiae arcanis praelectiones quasdam inter nosmetipsos habuerit. Idem quondam (ut ad remotiora transeamus) Ottomannorum inter milites arti medicae deditus, in ipsa Epiro, prope Pindi montes, prope Dodonae antiquae diu desertum oraculum, velut ἰατρόμαντις aliqui, consulentibus respondebat. Ad eundem postea Respublica Argentina, morbo gravi et inexplicabili oppressa, velut ad oraculum aliquod misit, cuius responsis obsecuta peste illa dira sese protinus liberavit. Inter antiquos quidem victimarum in visceribus rerum futurarum praesagia quaerebantur; hic autem, non vanus haruspex, ex ipsis morbis quos alii reformidant, ex ipsa Morte quae aliis tacet, veritatem ipsam audacter extorquet,—adeo ut Catonis verbis profiteri possit:

me non oracula certum
sed mors certa facit.[1]

Vobis praesento Medicinae Doctorem Edinensem, Pathologiae Professorem Cantabrigiensem, CAROLUM SMART ROY.

[1] Lucan, "Pharsalia," ix. 582.

SOCIETIES AND ACADEMIES

LONDON

Physical Society, November 22.—Prof. Guthrie, President, in the chair.—Mr. James Bewsher was elected a member of the Society.—The following notes were read by Mr. R. T. Glazebrook, M.A., F.R.S. :—On the permanence of some standards of electrical resistance. The author has had occasion to compare with ten standard B.A. units a coil which had been tested by Lord Rayleigh in 1882, the coil then being two years old. He found that its resistance was 9·98335 B.A. units at 14°·05 C., while Lord Rayleigh found the value 9·98330 B.A. units. Thus, either the coil and the standards have changed by exactly the same amount, which is improbable, for they are wires of different thickness, or they have all remained permanent.—On the effect of moisture in modifying the refraction of plane-polarised light by glass. The author described some experiments he had been engaged in lately at the Cavendish Laboratory. Plane-polarised light is made to fall on a plate or a wedge of glass at various angles, and the position of the plane of polarisation determined. It is found that this depends greatly on the hygrometric condition of the air in the neighbourhood of the glass. If moist air be blown on to perfectly clean glass, the plane of polarisation of the emergent light is displaced from its normal position in one direction, while, if dry air be blown, it is displaced in the opposite direction. At an angle of incidence of 60° the difference between the two positions is from 6′ to 8′. If, however, the glass be not perfectly clean, the effect of moisture is *at first* the same as that of dry air, though on stopping the draught an opposite effect is observed. The author assigns as the cause of this the heating of the surface, which, as Magnus discovered, is produced by a draught of moist air. He finds, on repeating Magnus's experiment, that the heating is not produced if the glass be clean, and he shows by an independent experiment that slight local heating does produce an effect on the plane of polarisation in the same direction as that due to the dry air.—Mr. Glazebrook also exhibited a spectrophotometer described by him in a paper read before the Cambridge Philosophical Society (*Proc. Phil. Soc.* vol. iv. part vi.), and made by the Cambridge Scientific Instrument Company from his design.—A note on a point in the theory of pendent drops, by Mr. A. M. Worthington, was read by the Secretary, Mr. Walter Baily. This was a note upon a paper recently communicated by the author to the Royal Society upon the measurement of the surface-tension of a liquid from the observations of the forms assumed by pendent drops. By making a measurement of a horizontal section of such a drop, and of the angle made by the tangent plane to the surface at the line where the section meets the surface with the horizontal, and knowing the density of the liquid, sufficient data are obtained to determine its surface-tension. Prof. Perry remarking upon this paper gave an account of some researches upon the subject, in which some years since he had assisted Sir William Thomson. On the usually accepted theory of surface-tension based upon the behaviour of liquids in capillary tubes, at every point of the surface of a liquid the equation

$$k\rho = \frac{1}{R} + \frac{1}{R'},$$

must hold where ρ is the pressure at that point or the difference of pressure on the two sides of the surface, R and R' the two principal radii of curvature, and k a constant. In the case of a drop whose surface is one of revolution about the vertical, the contour may be drawn from the equation. This was done, and theoretical drawings were made of a number of drops. These have since been compared by Sir W. Thomson with enlarged photographs of actual drops, and the results are highly satisfactory. This law no longer holds in the case of a drop at its "critical point," or that point when it is about to fall, since here dynamical action comes in.—Mr. Baily also read a paper by the same author on a new capillary multiplier. This is an apparatus for the measurement of surface-tension, and is a modification of one used by M. Despretz. From one extremity of the arm of a balance is suspended a roll of platinum foil, consisting of a strip 50 cm. long and 5 cm. or 6 cm. broad, rolled up, the successive convolutions being prevented from touching by rolling up with the foil a number of small pieces of hard glass tubing about 2 mm. diameter, which occupy the upper part of the helix, and preserve the form of the lower. The coil is cleaned by igniting it in a Bunsen flame, and then suspended with its lower end in the liquid to be examined. The increase in weight corrected for the part of the coil immersed is due to the fluid rising between the convolutions. From this the surface-tension is readily calculated.—Mr. Hilger described a new solar eye-piece. In Prof. Pickering's eye-piece there are two rectangular prisms of glass of slightly different refractive indices. The light of the sun undergoes partial reflection at the surface separating the two prisms, the ratio of the reflected to the incident light diminishing with the difference between the refractive indices. It is found, however, that such a prism under a high power always gives a double image, due to the two glass surfaces, it being practically impossible, even under enormous pressure, to bring them into true contact. To obviate this Mr. Hilger makes the second prism of Canada balsam, which gives the most satisfactory results, the image being pure and single.

VIENNA

Imperial Academy of Sciences, November 6. — On the fossil flora of the breccia of Hoetting, by C. von Ettingshausen.— On resorcin-blue, by P. Weselsky and R. Benedikt. — Carcinological notes, by K. Kœlbel.—On a reduced organ in *Campanula persicifolia* and in other species of Campanula, by E. Heinricher.—A new method of combating Phylloxera, by G. Henshel (sealed packet).—Contribution to the anatomy of the male organs of generation, by E. Finger.—On the bodies formed from hydroquinones by melting soda, by L. von Barth and T. Schreder.—On the temperature of the Austrian Alpine countries (part 1), by E. Hann.—On oxyphosphinic acids, by W. Fossek.—On the length of the year of Sirius, by Th. von Oppolzer.—On the figure of light-waves in the magnetic field, by E. von Fleischl.—On diluvial man from the caves of Stramberg (Moravia), by T. N. Woldrich.

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